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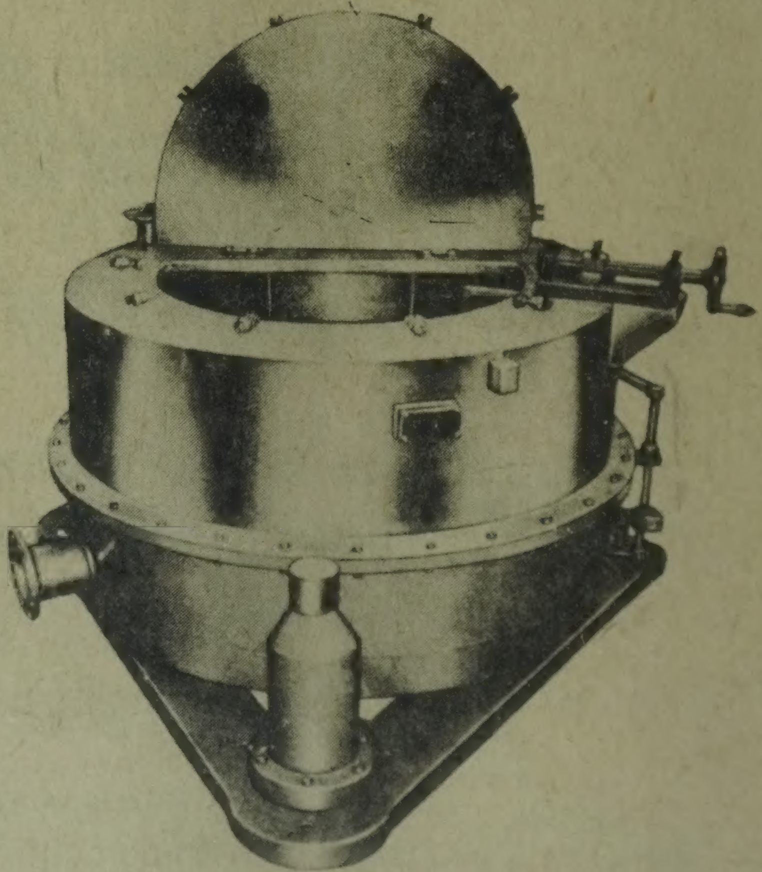

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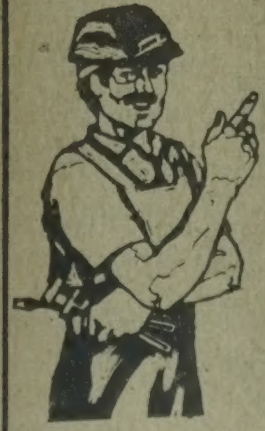

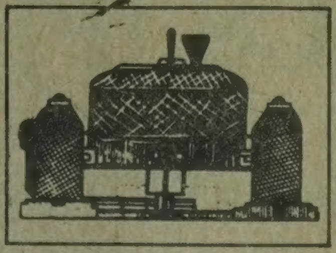

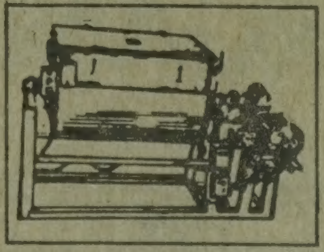

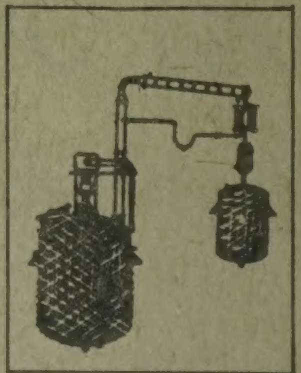

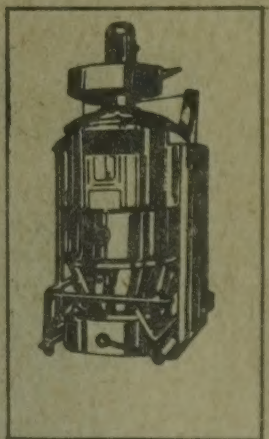

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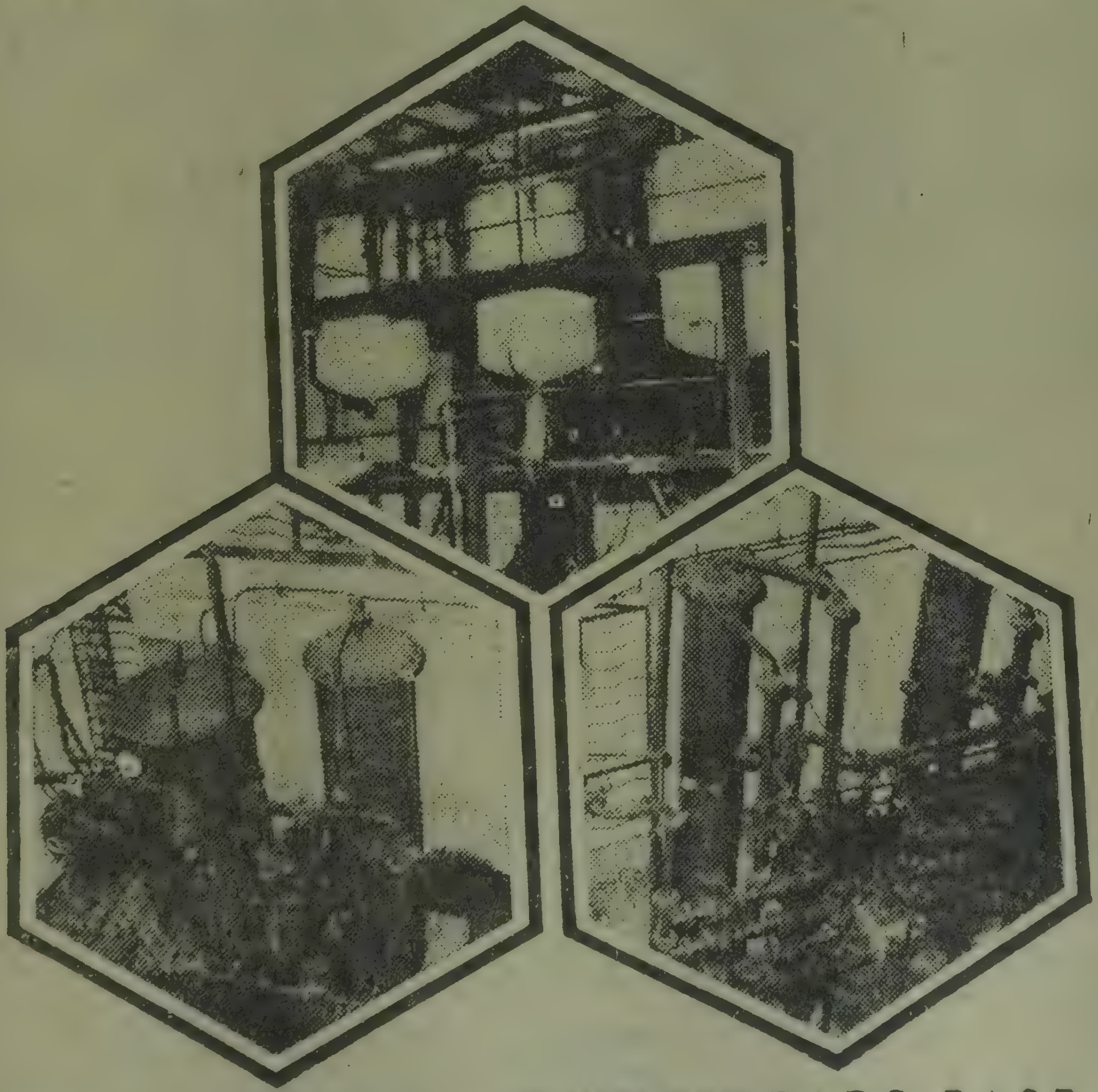

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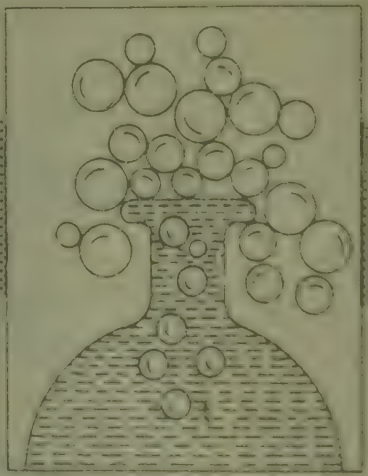

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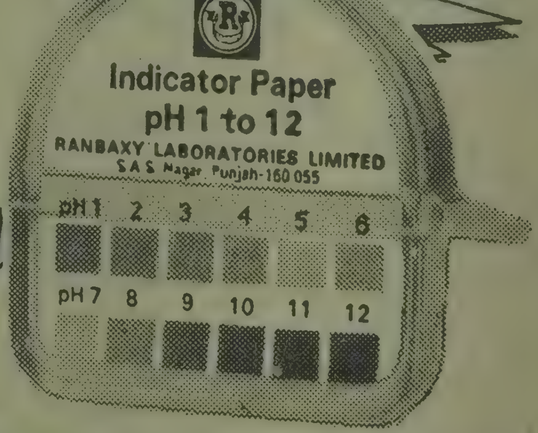

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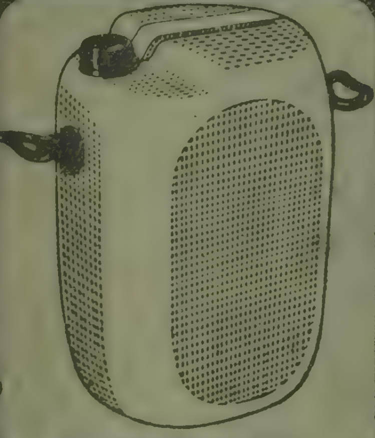
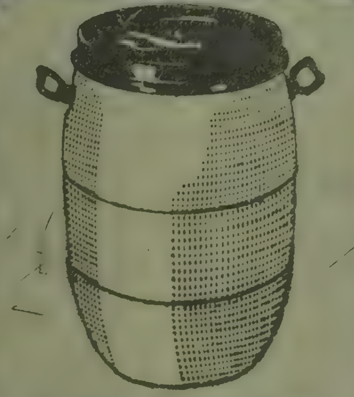
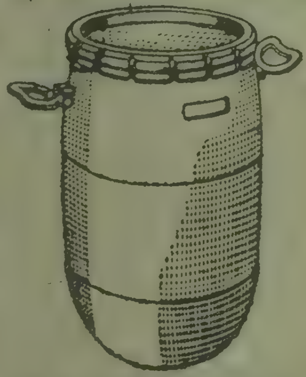


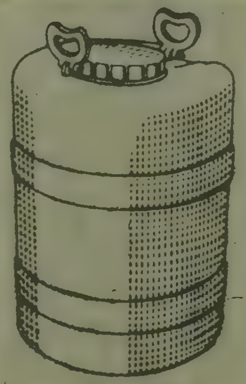
50 Ltrs. Jerry Can



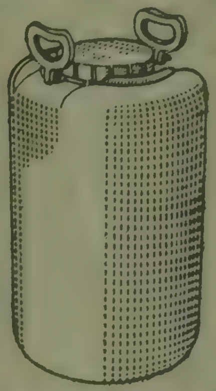
50 Kgs. Round Drum
Full Top Open – 12" Cap



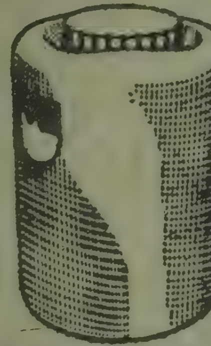
30 Kgs. Round Drum
Full Top Open – 10" Cap



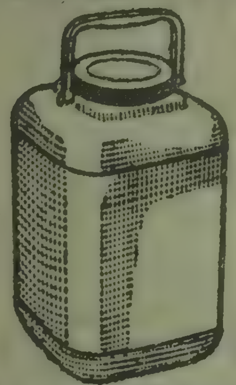
50 Kgs. Round Drum
– 6" Cap



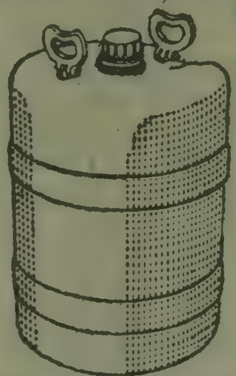
30 Kgs. Round Jar
– 6" Cap



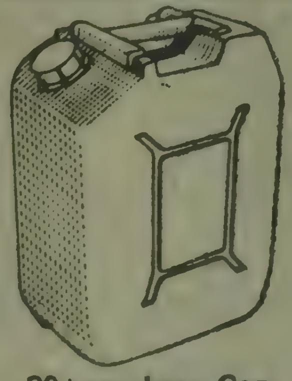
20 Kgs. Round Jar
– 6" Cap



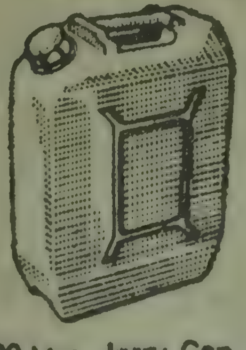
6 Kgs. Square Jar
– 4" Cap



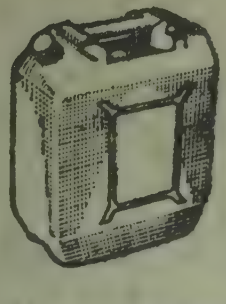
50 Kgs. Round Drum
– 2" Cap



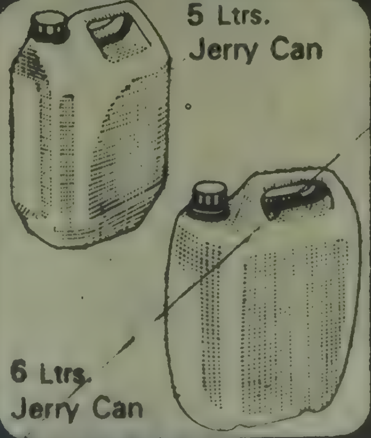
30 Ltrs. Jerry Can
Stackable



20 Ltrs. Jerry Can
Stackable



10 Ltrs. Jerry Can
Stackable



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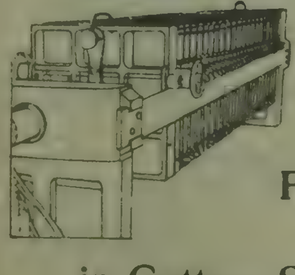

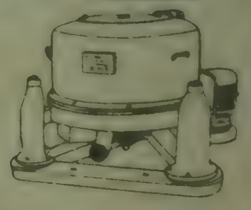

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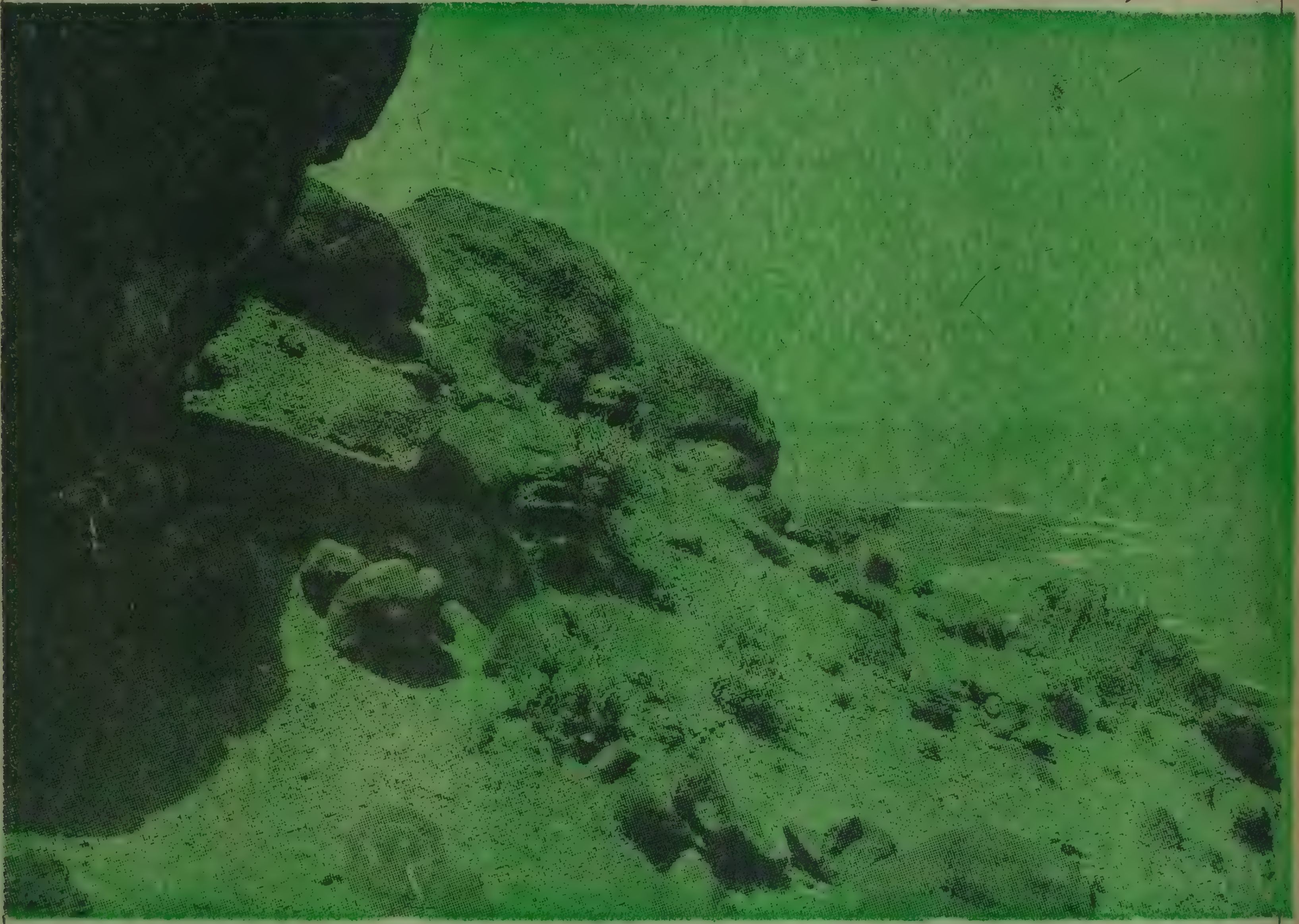

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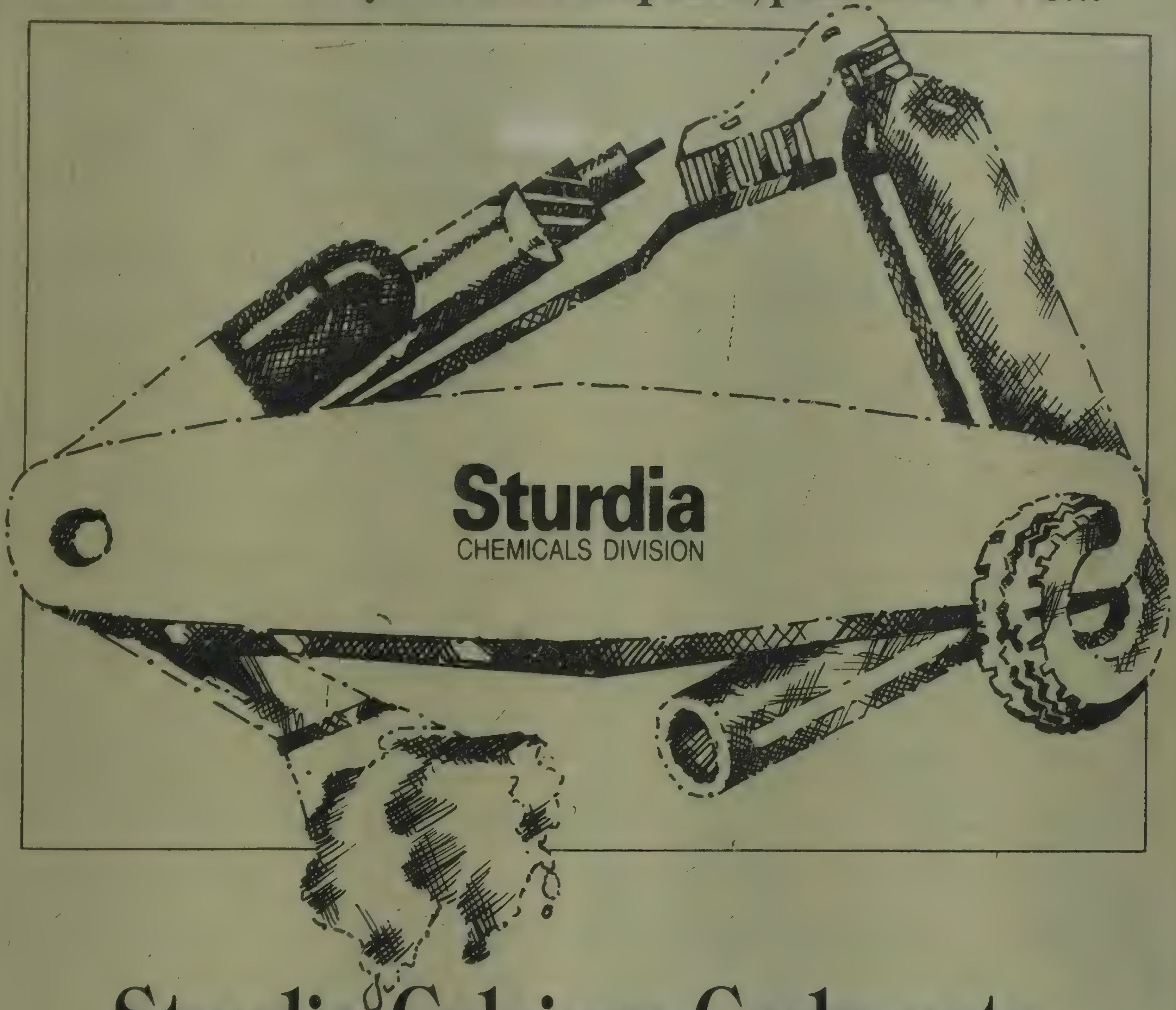

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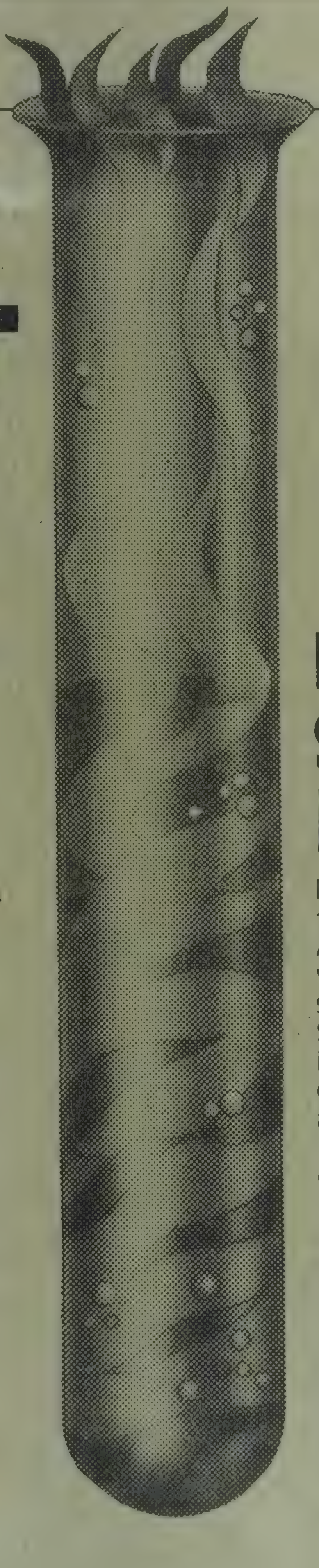

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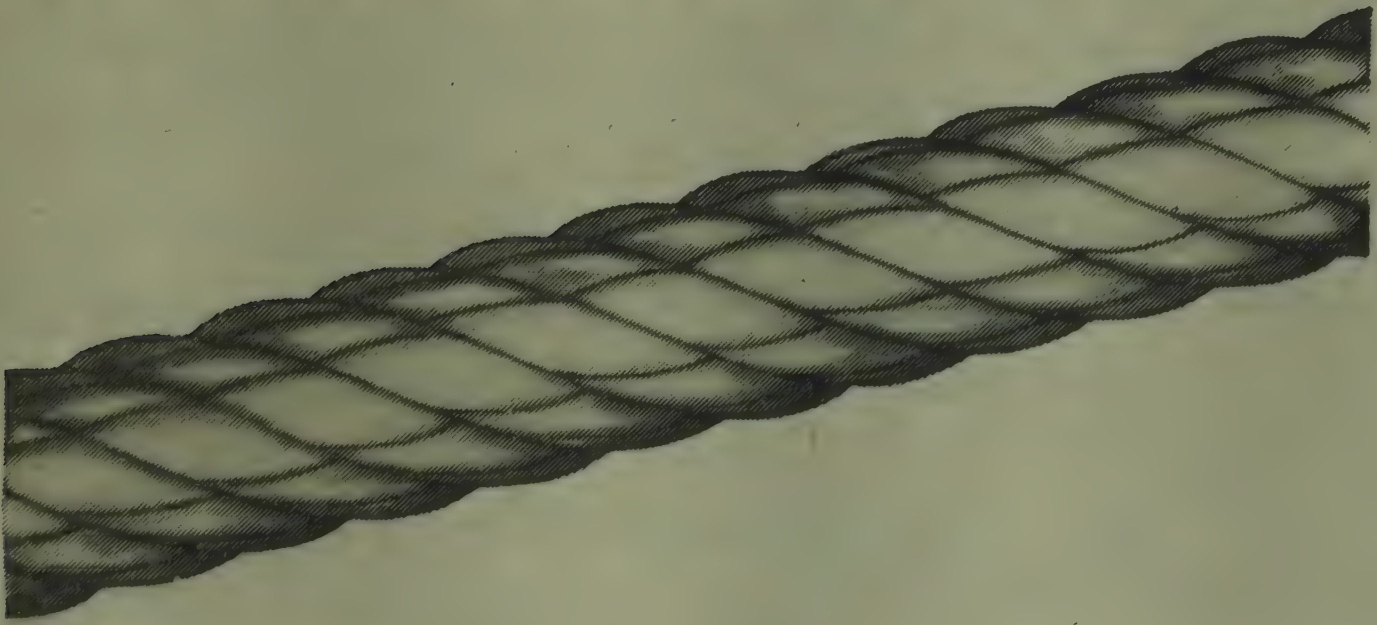

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HERALDING THE 21st CENTURY - 52

Future use of Coal — Coal and the Environment

World Energy consumption continues to climb up at an increasing rate. Total global primary energy demand grew by 3.7% to 8.1% billion tonnes of oil equivalent in 1988. One significant fact is that the most rapid growth in energy demand occured in the industrialising countries of South East Asia where the energy consumption rose by 11% to 241.8 million tonnes of oil equivalent but this represents only about 3% of global figure.

The development of power engineering in the Asian, African and Latin American countries is a subject of special concern. Whereas now they account for an insignificant percentage of global energy consumption, by the end of the century their share is expected to rise to about one-third, while by the year 2025-2030 the share of the developing countries will constitute half of the world energy consumption. That is why burden of the world energy problems towards the developing countries calls for the adoption of urgent measures to reshape their energy industries. But it need not be a simple transfer of technology from developed nations. The emphasis has ought to be on local resources and developments of indigenous technologies for greater economic benefits and progress.

In the context of anticipated accelerated energy consumption of the developing countries, the growing of adverse criticism against coal combustion on environmental grounds is a matter of grave concern which is bound to affect the future of the third world.

The shift away from fossil fuel might offer some relief on a global basis but coal has to develop a new effective "greenhouse" technology to assert its role. Malcolm Edwards, one of the world's leading energy technologists while addressing the Pacific Rim Coal Conference summarised the position as under: "Coal has won the economic argument, it is the cheapest fuel. But the problem is that it is under an unprecedented attack from those who try to label it as the chief pollutor of the universe. It is patently not true but the fuel which now produces 40% of the world's electricity and produces it cheaply will pay dearly if it allows the damaging and false argument to gain ground".

Citing one example of the success achieved by coal in its fight to evolve small, clean, high efficiency power generation plant, he referred to combined cycle coal fired generator plants offering efficiency increases of 20% and more and said that this process is the most important single issue for the immediate future of the world steam coal business. Besides cutting the risk of acid rain, it would further reduce the contribution made by coal fuel stations to the greenhouse effect which is only 7% now. The general public has to be made to realise that electricity generation from coal is at least as good environmentally as from oil while coal is about a third cheaper to run, the reserves would last at least six times longer than oil. One can feel more secure with coal as an energy resource of the future. He concluded "Burnt in the modern way, coal is infinitely more benign than nuclear."

Innovative use of coal. In recent times, the need for the conservation of energy resources and the need to protect the environment have increased the pressure for improvement. The results of these pressures are shown in the reduced energy requirements of modern manufacturing processes as reflected in the relationship between energy consumption and the gross domestic product in advanced countries.

In particular industries the improvement has been very dramatic. For example, in the electicity industry the efficiency of utilisation of fuel has doubled in the last 50 years. Similarly in the metallurgical industry the amount of energy required per ton of iron has been halved in the last 50 years.

These improvements do not happen automatically; they represent considerable effort by scientists and engineers collaborating together to improve existing industrial processes and to introduce new technology. Successful innovation is the product of fruitful interaction between fundamental research — probably best carried out in universities, development or applied research — probably best carried out by industry, and strategic research which is long term in nature and which usually requires a combination of industrial forces on a national or international scale.

Coal characterisation. Some of the special expertise which is needed to be developed to bring about the advances in the technology of coal utilisation arises because coal is a solid. Chemical engineering has largely been developed on systems handling gases and liquids, solids handling is at a comparatively early stage. The other reason for special expertise arises from the nature of coal itself. It is extremely variable in composition and contains mineral matter which is some times intimately mixed with the coal substance, but may also be present as discrete minerals. In European coals most of the mineral matter is in the latter form, i.e., it is discrete from the coal substance. In some southern hemisphere coals much of the mineral matter and the coal can be extricably mixed.

Coals are commonly characterised in terms of their volatile matter, swelling properties and ash content. These characteristics define coal type but are not absolute quantities. The conditions under which they are measured need to be carefully controlled in order to produce consistent and meaningful results. The standard conditions, which are the basis of international classification, are those for which the results are most readily interpreted in the context of making coke, and in particular to the behaviour of coals when heating in coke ovens.

Petrographic expertise has similarly concentrated on the characterisation of coal and cokemaking. However, most of the coal used in the UK and in the world is not used for coking; it is used for burning, in the most part for electricity generation. Of the world production of coal in 1987 (4.6 billion tonnes) about half was used for electricity generation. The parameters used for characterising this coal remain, however, same as those derived from the coke industry. In the conditions obtaining in a power station boiler, cost behaves quite differently from the predictions of the standard tests. At the high temperatures and heating rates encountered in modern pulverised fuel burners, and with small particles in dispersed systems, the volatile matter may be significantly greater than that predicted.

At high temperatures and in high pressure systems, the swelling properties of the coal may also be considerably different from the predictions of the standard tests. In the UK a considerable body of expertise has been built up which relates the results under these conditions reasonably well with the standard tests. This means that the standard tests have not needed to be replaced by tests more specific to the end use. This correlation does not, however, hold for the new sources of coal which are being considered internationally. Petrology may enable the coal scientist to characterise the newer sources of coal but no general agreement is in sight of an international system of classification.

Pollutant elements in coal. In response to the increased sensitivity to the environment, more attention has been paid in recent years to the way in which potential pollutant elements occur in coal and in the products of coal utilisation. The major elements of concern are sulphur, nitrogen and chlorine. About half the sulphur in coal occurs in the mineral matter and as such is in principle amenable to physical separation but subject to the limitations imposed by the size of coal which can be satisfactorily handled in practical preparation systems. the remainder of the sulphur occurs organically bound to the coal substance, as an integral part of the coal molecules. This sulphur is not amenable to physical separation. Its removal from coal could be achieved only by severe chemical methods, which would be prohibitively expensive and would result in the complete break-down of the coal itself as in a total liquefaction process. Whatever its form, virtually all of the sulphur in a combustion process is converted to sulphur dioxide and therefore has to be dealt with as a pollutant gas.

Nitrogen occurs in coals mostly in two organic forms in quantities related to the rank of the coal, and like organic sulphur would be prohibitively expensive to remove from the coal by chemical means.

When coal is burned it breaks down under the effect of heat into volatiles and a solid residue. The nitrogen in the coal passes into these components which then burn in the combustion air. Some of the nitrogen is converted into gaseous oxides in the flue gas, but some leaves as nitrogen gas. In typical industrial combustion systems, 15-20% of the nitrogen in the coal leaves the plant as gaseous oxides. High temperatures and high oxygen concentrations favour oxide production. High carbon and low oxygen concentrations favour the formation of nitrogen gas. At very high temperatures the nitrogen in the combustion air can also react with the oxygen to become oxides, but unless the temperature is in excess of about 1200°C the proportion converted is a small component of the total nitrogen oxides produced in the combustor.

Once the mechanism of the formation of oxides of nitrogen has been elucidated and the importance of reduced air supply and low temperatures are understood, these features could be used for the design of improved equipment:

- for pf boilers, low NOx staged burners have been successfully introduced by the burner manufacturer. Designs are now being adapted to suit the different kinds of power stations.
- in bubbling fluidised beds, staging can be introduced by minimising the primary air used for fluidisation and introducing secondary air above the bed.
- in circulating fluidised beds, operating at low temperatures and with long residence times, conditions favour low NOx operation.

By contrast, the only way that oxides of sulphur can be removed is to convert them first into a solid form. The most common way of doing this is to react the sulphurous gas with lime or limestone which is then converted into a solid product and can then be removed from the gas.

The conditions for the reaction have to be chosen with care particularly in respect of temperature. If the temperatures are too high the sulphur product is unstable. For this reason adding lime or limestone to the combustion temperature of a pulverised fuel system is not effective; better results are obtained at the lower temperatures of a chain grate stoker, but the best results are obtained in fluidised beds which operate at the temperatures favouring the capture of sulphur dioxide.

As an alternative to the direct injection of limestone, sulphur dioxide can be washed out of the flue gases. This is the basis of the systems now to be installed by the CEGB as their contribution to the national reduction in SO_2 emissions which was agreed earlier this year. The processes are expensive, adding some 10% to the capital and operating costs of large boiler plant. On a smaller scale such plant becomes proportionately more expensive in terms of costs per tonne of sulphur removed, even when meeting the lower percentage reduction standards for the smaller plant.

Chlorine is not bound to the coal organically. In British coals it is present in ionised form on the coal surface. In principle therefore it is amenable to removal by washing but again in practice removal is limited by size considerations because some of the chlorine is contained in very small pores in the coal. The chlorine leaves combustion equipment as gaseous hydrochloric acid.

For the most part other elements of concern do not become gaseous pollutants; they appear in the solid residues. However the proportions in which they appear in the different solid residues differ from one appliance to another depending largely on the temperature regime and on the prevailing oxidation reduction conditions.

There is today a clear understanding of the occurence of the pollutants in coal and it can be confidently stated that technology is available at reasonable capital and operating cost to meet the challenges posed by the ever increasing stringency of the standards of air purity.

—T.P.S. RAJAN

CHEMARENA

S.L. VENKITESWARAN

Recycling of Plastics

The disposal of plastics wastes in millions of tonnes and large volumes year after year is the real problem staring in the face of the developed countries. Some hesitant steps are taken to recover and recycle such plastics scrap from specified dumps in the urban areas and process them to usable material. The one who throws away the material gets nothing and the waste is at zero cost at the dump. A recent estimate of costs for collection, screening, grinding, washing and drying before pelletising into the reusable form has been given below (*Chem. Week* of 2/5) and gives rather a grim picture on the economic side.

	Cents/lb
Raw material	0
Collecton	5-6
Sorting	2-3
Grinding	4-6
Washing and drying	6-10
Total recycling cost	17-25
Pelletising etc.	10
Profit	3
Total	**30-40**

Unless the cost of virgin material is well above 40 c/lb it is a serious problem of losses to the recycles if he is an independent operator. There is also the resistance to the reprocessed plastic unless there is a discount. High cost materials like polyester may not face hurdles but in these cases the use of the waste items like bottles can be more conveniently collected for reuse.

In the US it is reported that the available land fills near urban areas are mostly filled up. The extent of land fill disposal of plastics in the advanced countries are estimated as given in the table alongside.

	US	W.Europe	Japan
% disposed as landfill	85	55	37
Incineration %	5	30	23
Recycling %	10	15	50

An important approach is to cut down on wastes at the source. The use of mixed wastes for trash bags by extrusion has been a limited success and about 100 million lbs are said to be disposed of and perhaps burnt up with the other urban waste. Incineration is expected to catch up but this is the culmination of the efforts of using synthetics.

But incineration of some wastes will be booming business. It is reported that Air Products Corpn. has a lead in this and generates an income of $ 50 million a year now which is rapidly going up. Air Products have contacts to handle the wastes from others -- who produce it -- and generate energy for supply. Air Products owns, finances, designs, constructs and operate the facilities on site under a long term contract. In some case the waste producer is a partner. Department of Energy gives generous support for such cogeneration projects based on organic wastes and many cities already generate substantial energy in this manner. Air Products is said to have a 60 MW power plant using 2200 tonnes a day of wastes in a part of New York and a few others elsewhere. The estimate of municipal waste streams in USA is over 150 million tonnes as solid content in liquid and another 300 million tonnes of solid waste. The waste generation per capita is enormous and going up all the time with better life styles. The scope for power generation is quite large even if it could be costly.

India is a better operator of recycling plastics wastes but how long will this go on and where will all the wastes of early 21st century end up?

Alternate to Phosgene

Phosgene or carbonyl chloride, a deadly gas is the recognised way to the important isocyanates particularly for TDI and MDI and for polycarbonate. It is also the intermediate for methyl isocyanate used for pesticides in the ill-fated Union Carbide plant in Bhopal which laid low thousands of helpless victims in the early hours of a cold misty morning five years back. But phosgene or methyl isocyanate leads to valuable chemicals and can be and are operated under fully controlled closed circle systems.

There has been a lot of effort to avoid the use of phosgene where possible and resort to the alternate methods to the desired products. A rational approach is needed for aromatic isocyanates which are made in a round-about way by nitration, reduction with hydrogen to the amine and then reaction with phosgene of the amino group to form isocyanate group and eliminate the hydrogen as hydrogen chloride gas. This standard technology could be avoided if carbon monoxide itself serves as a reducing agent of the nitro group and also end up as part of the isocyanate. Some claims have been made of success in such a process by development of special precious metal catalysts but even after a decade it is probably not ready to go commercial. Phosgene continues to be the mainstay for the isocyanates and urethanes from these -- a big sector of plastics.

There is now claims of an alternative in the use of DMC -- dimethyl carbonate for another phosgene-based plastics -- polycarbonate from bisphenol A. Enichem of Italy together with Mitsui of Japan in a joint venture claim success for their DMC process for many fine chemicals where phosgene has been used. The joint venture Miltcas is promoting this process and is planning to use it for a 40,000 tpa polycarbonate plant in Japan. The reaction is also said to be a move away from the three phase system for reacting phosgene and amines in an interfacial operation. The new process, details of which are not clear, is said to be a "melt process' with diphenyl carbonate using DMC and covered under new patents with proprietory catalysts for polycarbonates.

Enichem is already making and selling dimethyl carbonate in tonnage quantities and the success with polycarbonate will provide a big boost. Products like allyldiglycidyl carbonate, linear alkyl carbonate and other oligocarbonates are being made. The big promise is in polycarbonate with the isocyanates soon after perhaps in the late nineties.

India is awkwardly placed with plans for isocyanates for urethane taking no final shape even after a decade of deliberation. It is reported that final decisions are expected soon on projects for TDI (toluene diisocyanate) and MDI (methylene bis diisocyanate) which will cover both flexible and rigid polyurethane materials. The only dependable technology using phosgene under perfectly safe conditions will be used with hydrogen chloride byproduct used for associated oxychlorination of ethylene EDC if possible or otherwise marketed profitably. Close links to chlorine is a sine qua no. Certainly the project should not suffer any delay if it is to face the DMC way to isocyanates after a few years or a success with carbon monoxide for reduction of nitro groups.

Telescope in Space

The breathtaking news of the month is the final launch of the Hubble Space Telescope from Kennedy Space Centre from the Space Shuttle Discovery. The Hubble Space Telescope is a NASA project and a technical marvel -- the most complex and sensitive space observatory ever built.

HST is to orbit 370 miles above the earth every 95 minutes and in the clear atmosphere it is capable of viewing 14 billion light years away with no distortions and catch up far fainter signals from distant space and give image resolutions 10 times greater. It is a "premier science mission of all time" at an estimated cost of $2.1 billion. What new data from space will be revealed for conjecture would be awaited with great anticipation over the next 15 years of its life -- may be even if it has little impact or sense for humdrum life on planet earth.

NASA has plans for more such telescopes to cover wider range of x-rays and infrareds and two unmanned rockets. The greatest achievement will be in the servicing of the telescope by astronauts launched from the earth. The telescope has the largest ever precision ground telescope mirror ever made and an enormous array of solar panels, high resolution spectrographs and transmitter systems. The huge 43 ft by 14 ft. diameter has wings of solar panels which will unfold in space.

There is a special insulation panel to protect and also a control system to rotate and pinpoint the focus on specific objects. The abundance of elements present in the space on the orbiting satellites or moons is expected to be revealed through high resolution spectrographs.

There is already talk of a new generation of space telescopes and instruments for them but no plans has emerged as what the world can make out of this.

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BICP price for p-xylene accepted

The Union Government appears to have accepted the fair price of paraxylene at Rs. 14,200 per tonne, which was used as the base price by the Bureau of Industrial Costs and Prices (BICP) to work out fair prices of its intermediate, dimethyl terephthalate (DMT). Replying to a question in the Rajya Sabha on May 14 as to whether the Government proposed to decide upon the fair price (selling) of paraxylene, the Minister for Petroleum and Chemicals, Mr. M.S. Gurupadaswamy, said there was no statutory control over the prices of paraxylene. However, BICP had given a price of Rs. 14,200 per tonne. "That should be taken as the fair price", he said.

However, Mr. Gurupadaswamy denied any particular party was being favoured and said there was a decifit of 48,500 tonnes of paraxylene in the country. The minister categorically denied that paraxylene imports had been permitted to enable DMT producers to sell the product at cheaper rates. Imports, he said, are permitted as per the prevailing import policy. Till the end of March this year, import of paraxylene was canalised through Indian Petrochemicals Corporation Limited (IPCL). Besides, direct imports were also permitted to a DMT producer as per the policy provisions.

Mr. Gurupadaswamy said that paraxylene imports have been shifted to the limited permissible list (appendix S 3A) in the new import-export policy to ensure that domestic production did not suffer for want of this key input. Revealing the name of the business house after persistent questioning by members, most of them from Congress-I, the minister said Bombay Dyeing had been allowed to import 12,000 tonnes of paraxylene earlier and was being given a licence to import an additional 4,000 tonnes. The contention of the members, Mr. Chaturanan Mishra, Mr. N.K.P. Salve, Mr. Vishwajit Prithvijit Singh and Mr. A.B. Vajpayee was that paraxylene imports were being permitted even when there were adequate quantities in the country leading to a waste of Rs. 20 crores in foreign exchange. Denying that any favour as being shown to any particular party, Mr. Gurupadaswamy said it was also untrue that the country was self-sufficient in paraxylene. In fact, the shortage was as much as 48,500 tonnes annually. He said it was true that Reliance had offered certain quantities to Bombay Dyeing, but there was a controversy over the pricing of paraxylene. This matter was referred to the Cost Account Branch (CAB) of the Finance Ministry.

Moreover, it has been the precedent that when the domestic prices of certain goods go up very high, imports are resorted to so as to bring down the prices. Similar is the case with paraxylene, he said. Mr. Salve, however, was not satisfied and sought permission for a short-duration discussion on the subject.

BID TO REDUCE FLARING: NEW GAS USE POLICY ON ANVIL

The government is considering several steps to reduce flaring of gas in the country. These include reducing crude oil production, setting up of more facilities for processing natural gas, and a new gas use policy. It has been estimated that India will have to reduce crude oil production by about 3 to 4 million tonnes per year or by 11.60 million tonnes over a three-year period, if it wants to stop completely flaring of gas by March 1993. This would mean that crude oil imports will go up by the same quantity. To finance these additional imports, one of the proposals now being examined is to take a bridge loan. It is felt that the loan could be for a four to nine year period and could be taken by the Indian Oil Corporation (IOC) which is the canalising agency for import of crude oil and petroleum products. Another alternative being considered is to cut the crude oil production by about two million tonnes per year to reduce gas flaring by 7 to 8 million cubic metres by March 1993. This could be done by reducing production of crude oil only from wells which have a very high gas oil ratio. Such a step, according to one view in the government would also repressurise the reservoirs.

Opinion on a such a step is divided. According to one view, though interest charges on a loan like this may be 8 to 10%, it would be cheaper than flaring of 11.03 billion cubic metres of gas, valued at about Rs. 3,000 crores. It would be possible to make up for the reduction in crude oil production over a six year period. However, according to another view, such a loan would add to the national debt which is already quite high. It is argued that a policy of reducing crude oil production could be pursued some years back when the prices were much lower. In fact, such a step was examined but rejected in the 1980s. The average price of crude oil this year for India is expected to be between $17 to $18 per barrel and the country is already finding it difficult to sustain imports of crude oil and petroleum products at the current levels of their consumption.

At present, about 30 million m^3 of gas is produced from Bombay High. Of this, about 14.5 million m^3 of gas is flared. Similarly, about 1.5 million cubic metres of gas produced from Assam is also being flared. The time between now and March 1993 is proposed to be utilised for setting up of processing facilities and downstream units to utilise the gas. One of the proposals is to set up an offshore gas processing platform in Bombay offshore area, take the surplus gas to Uran via the pipeline network and stop the production of free gas for this period. Certain steps are also being considered to reduce flaring of gas from the onshore Gandhar Oil Field. A new gas utilisation policy which will permit greater utilisation of gas is also being formulated now.

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Hoechst may raise stake in PIL

Hoechst AG of West Germany is likely to increase its stake in Polyolefins Industries Ltd. (PIL) to 40%. Increasing its equity in the Indian company from the existing 31% to 40% will help PIL to part finance the foreign exchange requirements of its expansion projects costing about Rs. 300 crores.

The following projects are under implementation: A 75 km pipeline connecting Indian Petrochemicals Corporation Ltd.'s Nagothane plant with PIL plant to supply ethylene, which will help increase its HDPE capacity. The EVA plant at Thane has stabilised production. The company is in the process of selecting technologies for a 20,000 tonne aniline plant to come up at Bharuch in Gujarat, as well as a 10,000 tonne project to manufacture EPM/EPDM (speciality synthetic rubbers). These two projects will together cost about Rs. 120 crores.

About 25 km of the ethylene pipeline is expected to be completed before the onset of monsoon. The work is expected to resume in mid-September and the pipeline is likely to become operational in November. This will cost the company approximately Rs. 30 crores. Another project under implementation is a Rs. 50 crore plant to manufacture 10,000 tonnes of polymer alloys and blends.

Even more exciting is the Rs. 60 crore project to produce polyacetal; a hi-tech engineering plastic, for the first time in this part of the world. PIL has signed a memorandum of understanding with Hoechst for transfer of this closely guarded technology. Two other units hold letters of intent for this product, but both have not been able to secure proven technologies. Polyacetal is a tough plastic which can replace metal in a variety of applications.

PIL has sought Government approval for increasing its HDPE capacity to 1.5 lakh tonnes based on additional ethylene supplies from the expanded cracker of National Organic Chemical Industries Ltd. (NOCIL), a sister unit. This project, costing about Rs. 200 crores, will depend on NOCIL getting its final nod later this year. Increasing its stake in PIL will be a logical step for Hoechst, which bought Bayer's holding in Colour-Chem last year. After its withdrawal from Mafatlal Dyes and Chemicals of Mr. Yogindra Mafatlal, Hoechst has been expanding its activities through three affiliates: pharmaceuticals through Hoechst India, dyes and speciality chemicals through Colour-Chem and polymers through PIL.

At present, Hoechst and NOCIL each have 31 per cent stake in PIL. Mafatlal Industries holds 2.5 per cent equity and the rest is widely distributed. PIL will soon have a Hoechst representative to head its R & D activity, in a move to integrate PIL R & D with that of Hoechst worldwide. The company is planning increased inroads into the export market. To begin with, the main products will be rubber chemicals and aniline derivatives. (PIL's LoI for aniline has a 30 per cent export obligation). Plans are also afoot to promote exports of finished products like woven sacks and tarpaulins and speciality chemicals based on PIL's products. Export during 1989-90 touched Rs. 9 crores. It is expected to reach Rs. 50 crores by 1994-95.

200M LITRES OF INDUSTRIAL ALCOHOL TO BE EXPORTED

The government has decided to allow the export of 200 million litres of industrial alcohol, which the industry feels will fetch Rs. 100 crores in foreign exchange. Last year, only 72 million litres were exported while the domestic consumption was 750 million litres against the installed capacity of 1,600 million litres.

The decision to export 200 million litres is likely to give a shot in the arm of the manufacutring units which have been on the verge of sickness due to low capacity utilisation that was only 46 per cent last year and 40 per cent in the previous year.

Welcoming the decision, the president of the All India Distillers Association, Mr. P.K. Pati, said the industry can now achieve a capacity utilisation of 60 per cent. He said the association is committed to meet the total requirement of alcohol for chemical and other industry and there will be no shortage, even in the deficit states. The country will have at least 500 million litres of surplus alcohol.

The association acts as a canalising agency for the export of alcohol. Its exports committee makes locations to various units depending on their installed capacity. The largest buyer of Indian alcohol is Japan, which requires 400 to 500 million litres every year. Some of the alcohol exported to Japan is made potable by redistilling.

Mr. Patil said there is a good international demand for Indian alcohol now. Two years back, India was offered only $240 per tonne against the international price of $290 but things changed after the buyers were convinced about the quality of Indian alcohol, he added. Foreign buyers demand alcohol containing 96% ethanol, while the Bureau of Indian Standards has fixed the limit of 94.6%.

PLEA TO EXPORT SURPLUS ALCOHOL

To ensure a steady off-take from distilleries, the Government should allow the release of a certain quantity of alcohol export, out of domestic surplus, according to the All-India Distillers Association. There is no difficulty in meeting the alcohol needs of the country as the surplus is so large that even after meeting all domestic requirements, a sizeable balance will have to be carried forward to next year.

Oswal Agro told to close down Chembur plant

Oswal Agro Mills Limited, the new owner of the Union Carbide plant in Chembur, Bombay and the adjacent Calico Chemicals (Plastics division), has been instructed by the government of Maharashtra to close down its petrochemicals plant at Chembur, under Section five of the Environment Protection Act with immediate effect.

The state government has taken this step following the reports that the Oswal Agro Mills Limited is planning to combine these two different but conteguously located industries into one and expand their capacity by three times. The move can have serious pollution problems not just for Chembur but also for the island city of Bombay.

After the Bhopal mishap the Union Carbide India Limited closed down its unit at Chembur. The plant remained shut for three and a half years from April 1986. Meanwhile Oswal Agro Chemicals Ltd., took over the plant and renamed it as Oswal Petro Chemicals. However, the plant was allowed to be re-opened in November 1989, with the existing capacity only after a committee went into the safety aspects.

Following the reports of the designs of the new owners to expand the capacity of the plant by three times, the Minister of State for Environment and Forests, Smt. Maneka Gandhi met the Chief Minister of Maharashtra, Shri. Sharad Pawar during her recent visit to Bombay.

As a result of the discussions, the state government has issued orders regarding the closure of the plant in Bombay. Meanwhile the chairman of the Rashtriya Chemicals and Fertilisers Limited has also been called to Delhi to discuss with the Minister of State for Environment and Forests, Smt. Maneka Gandhi, the problem of pollution being caused by the RCF plant in Bombay.

Only routine show cause for Oswal

Oswal Petrochemicals, Bombay, has received only a routine show cause notice, and has not closed down the plant.

It is a normal notice, asking the company to comply with certain requirements within 15 days, failing which the plant will have to close down. Such notices are issued by Factory Inspector, ESI Inspector and other officials, according to a company source.

The company is complying with the requirements. Engineers India Ltd., a public sector undertaking, has been associated with the revamping of the Chembur plant from the beginning, and has cleared the plant's operations from all angles. The detailed report of EIL is being submitted to the Environment Department.

NO DOUBLE PRICING FOR PETROL, DIESEL

The Government is not proposing adoption of the double pricing system for petrol and diesel, the Rajya Sabha was informed on May 14th.

The Government is also not considering any major departure from the existing energy-fuel policy, though fuel/energy options are adjusted on a continuing basis from time to time.

The Energy Minister, Mr. Arif Mohammed Khan, said in a written reply that the present policy framework laid emphasis on accelerated exploitation of domestic energy resources, energy conservation and development and exploitation of new and renewable sources. He said in reply to another question that the energy demand by the end of the Eighth Plan will be of the order of 385 billion units.

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THREE FERTILISER COMPANIES IN A QUANDARY

No move to resume gas supply

Repeated pressure from the Ministry of Petroleum and Chemicals on three fertiliser units, asking them to approach Gas Authority of India Ltd. (GAIL) for reallocation of gas, has been of no avail. This has followed the official letter from GAIL on May 2 cancelling gas supply to the three plants — Chambal Chemicals and Fertilisers (Gadepan), Tata Chemicals (Babrala), and Bindal Agro (Shahjehanpur).

Official sources concede that though negotiations are on, no headway has been made so far. In fact, the failure in official circles, is being mainly attributed to the present vacuum in the Department of Fertilisers.

In the absence of a Secretary, Ms. Otima Bordia having been shifted to UPSC on May 11, no official representation on behalf of the units from the department has so far been made to the Petroleum Ministry.

However, sources are confident of the concerned authorities coming to terms keeping in view the investment of Rs. 2,100 crores in the three plants as well as the wastage of flared gas that would take place. The GAIL contract seeks to impose stringent penalty clauses on units in case of any abandonment or delay in gas supply plans.

Surprisingly, GAIL is seeking to introduce penalty measures on its largest consumer, the fertiliser sector, keeping itself away from any corresponding obligatory measures for shortfall or non-supply of gas. Interestingly, in the same context, sources in fertiliser units point out a recent discrepancy whereby the Aonla project in UP along the HBJ pipeline was forced to use an alternative feedstock of naphtha due to non-availability of gas in time by GAIL.

The three fertiliser units are a spillover from the Seventh Plan and are yet to go on stream. Sources at New Delhi point out that in the absence of gas supply, the raw material for fertilisers, imports would have to be resorted to. Alternatively, naphtha, a far more expensive raw material, would have to be used.

The contract stipulates a deposit of Rs. 4.4 crores besides a bank guarantee of Rs. 13.2 crores. However, it is understood that such a stipulation would adversely affect the liquidity position and also cause a substantial loss in interest. This, in turn, would affect the viability of the plant.

The provision for forefeiture of this amount in the event of any delay in offtake of gas is yet another condition. Industry sources reveal that since the commissioning of a project depends on numerous factors beyond the control of the authorities like Government clearances, timely supply of equipment, etc., the provision is uncalled for.

The GAIL contract also demands a guaranteed minimum off-take and provision for payment even in the absence of gas being fully drawn. However, what irks the fertiliser plants are the unaccounted operational hazards like breakdowns and equipment failures due to high temperature and pressure conditions that prevail in a chemical processing industry.

GAIL has also fixed prices for gas with calorific values in the range of 8,500 to 10,000 Kcal. However, the consump[tion of gas for every tonne of ammonia/urea depends upon the calorific value of the gas. The absence of any appropriate adjustments of this account would thus bring about a wide variation in the cost of production.

GAIL has warned consumers that the pressure of gas supply would not be more than 20 kg cm^2. This, according to industry sources, would necessitate compression facilities at the plants, involving additional expenditure.

UNIFORM RATE OF DUTY FOR DMT, PTA

The Finance Minister, Prof. Madhu Dandavate, announced a uniform rate of 15 per cent duty on both DMT and PTA on May 16, thus removing the differentiation in the rates of excise duty on these inputs which are used in the manufacture of polyester staple fibre and yarn. In the Budget, the Finance Minister had imposed a basic excise duty of Rs. 4.40 per kg on PTA and Rs. 3.60 per kg on DMT.

Moving modifications to the Finance Bill for consideration in Lok Sabha, the Finance Minister also reduced the excise duty on polyester waste arising in the manufacture of such fibre to Rs. 5 per kg.

Mr. Dandavate said that as an anti-evasion measure, he has proposed to reduce the excise duty on synthetic woven sack from 8 per cent to 5 per cent and to increase the excise duty at the tape stage from Rs. 3.70 to Rs. 3.85 per kg. The excise duty on metal containers made of steel has been reduced from 20 per cent to 15 per cent.

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16 THERMAL POWER PLANTS ARE SANS POLLUTION CONTROL:

Sixteen coal-based thermal power plants in the country have neither installed any pollution control devices nor submitted any time-bound programme for installing such devices, the national task force on thermal power plants has said.

The task force, which reviewed pollution control measures in 68 coal-based thermal power plants, found that another 19 plants were only partially complying with emission standards.

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Chemical Industries Association's Holds Interface meeting at Kerala with IRBI

Chemical Industries Association's Kerala Chapter had arranged for mutual benefit, an interface meeting for Kerala industrialists, members and non members with officers of Industrial Reconstruction Bank of India on 9th May 1990 at Mascot Hotel, Trivandrum.

The meeting was attended by Mr. Krishnaswamy, President of Kerala Chapter of the Association, besides 40 industrialists and entrepreneurs, representatives of the Kerala State Industrial Development Corporation Mr. K.A.L. Narayanaswamy, their Manager (Projects) on the organisers' side and Mr. C.K. Das, General Manager, IRBI (Calcutta) and Mr. G. Venkatakrishnan, Deputy General Manager IRBI at Madras, whose office has jurisdiction over Kerala and Pondicherry besides Tamil Nadu.

Mr. Krishnaswamy welcoming the gathering and representatives of the Kerala industrial organisations and the officers of IRBI, outlined the major areas covered by IRBI in industrial finance and stressed the idea that the IRBI should not be conceived as a hospital designed to treat only 'Sick Units. He requested the IRBI officers to outline their operative areas and the members present to clarify their doubts related to IRBI's functions.

Mr. Das and Mr. Venkatakrishnan succinctly outlined the spectrum of IRBI's areas of aids under different terms and conditions offering financial aids for:

1. Term Loan assistance for modernisation, renovation, diversification, expansion of Industrial Units in the Corporate and Co-operative Sectors.
2. Equipment Leasing, Hire Purchase and Equipment Finance Scheme for capital goods involving what are necessary for Pollution and Hazards Control.
3. Line of Credit Scheme for tiny & small units to be arranged through State Level Institutions — mentioning that Kerala's SIDCO had drawn an appreciable sum under this Scheme, and
4. Margins for additional working capital.

The points "Who can get it?, how does it work?, Margins needed from entrepreneurs, rates of interest, the repayment period, mode of payment, types of leasing, how to apply?, time taken to sanction to deserving cases etc", with reference to all these areas were succinctly and clearly explained by the officers.

At the floor level, exasperated by the usual apathy evinced by the Banks and Industrial Financial Institutions in general especially those units of medium and small scale sectors who are generally circumscribed by the inability to call for deposits, public subscriptions etc. and company law regulations if existing as private or public limited, the audience raised a lots of questions and each of them was clarified by the IRBI officers so far as their institution is concerned and assured that provided data are given correctly and fully as may be needed for appraisal, IRBI will speedily dispose the approvals and the minimum time that will be taken it about three months.

CHEMICAL INDUSTRIES ASSOCIATION

Seated from left to right are: Mr. N. Venkateswaran, Secretary Association, Mr. K.A.L. Narayanaswamy, Manager KSIDC Trivandrum, Mr. G. Venkatakrishnan, Dy. Gen. Manager, IRBI Madras, Mr. C.K. Das, General Manager, IRBI Calcutta, Mr. S. Krishnaswamy, President, Association at Madras and Mr. C.V. Paul, President, Association's Kerala Chapter.

IPCL joint venture likely to manufacture AO

Indian Petrochemicals Corporation Ltd. (IPCL) which set up a joint venture with GE Plastic of Holland early this year, is likely to set up another joint venture to manufacture alpha olefins. This is because one of the leading companies with alpha olefin (AO) technology is willing to part with the same without an equity participation. This is a closely-held technology dominated by Shell in Europe, Ethyl Corporation and Chevron in the US and some Japanese firms, among others.

IPCL is not averse to setting up a joint venture. Yet another joint venture in which a global chemical giant has an active participation will help IPCL to keep abreast of the latest technological advances on a long-term basis and promote its goal of playing a bigger role in the international scene. IPCL has a letter of intent to manufacture one lakh tonnes of alpha olefins at Gandhar, besides 1.2 lakh tonnes of ethylene oxide/glycols and one lakh tonnes of polyvinyl chloride. Unlike alpha olefins, technology for the other two products are available off the shelf, and IPCL is already producing them at Baroda.

The Gandhar complex is the only one among the many proposed crackers making good progress. A detailed feasibility study on the project with detailed costs for each products expected to be ready by the month-end. The project will then go to Public Investment Board (PIB) and later to the Cabinet. A final clearance should hopefully be through by June.

IPCL has already paid Rs. 2 crores to Gujarat Industrial Development Corporation for land. The total cost of the cracker and downstream project is expected to be in the region of Rs. 2,300 crores. The company is in a position to raise about Rs. 1,300 crores on its own. Financial institutions consider IPCL extremely credit-worthy and World Bank assistance is also most likely.

Use of alpha olefins in India has not grown beyond the detergent indutry. All leading detergent manufacturers are now using alpha olefin sulphonates. Hindustan Lever is using AOs for its well-known "Wheel" detergent cakes. The burgeoning liquid detergent market is also patronising AOs in a big way.

Out of its one lakh tonnes capacity for AO, IPCL will be producing about 25,000 tonnes of detergent grades AO. The rest are lower cuts and tailings for which demand exists but a lot of pioneering marketing work is called for. Some of these grades include comonomers (for polyethylenes), synthetic acid esters, plasticiser alcohols (PVC), trimers (lube oils), epoxides (diols and

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hydroxylamine), mercaptans (herbicides and fungicides), aldehydes, detergent alkylates, alkyl sulphates, alkyl phenols, alkyl halides, tertiary amines, nitrites, phosphines and the like.

Gujarat Godrej Innovative Chemicals Ltd. is meanwhile, setting up a 35,000 tonnes plant for detergent grade alpha olefins, its precursors and derivatives. The process involves continuous splitting of vegetable oils into fatty acids and glycerine. Fatty acid is then converted to fatty alcohol using Lurgi process. Fatty alcohol is then dehydrated to AO, based on Godrej soaps' process which has now been patented in India and the UK. The economics of ethylene route versus Godrej of cess is not yet known.

PATALGANGA CAPACITY: CUSTOMS SERVE NOTICE ON RIL

The customs department has served a show-cause notice on Reliance Industries Ltd. (RIL) on May 11 for alleged misdeclaration of manufacturing capacities at the PTA and paraxylene plants at the company's Patalganga complex, claiming evasion of duties to the tune of over Rs. 174 crores.

The notice was issued under section 111(d)(m) of the Companies Act. The show cause notice alleges that RIL has an installed capacity of 1.9 lakh tonnes per annum of PTA as against the licence to import a plant with a capacity of 75,000 tonnes per annum. In the case of paraxylene, the notice alleges that the company has a capacity to manufacture nearly four lakh tonnes annually, as against the declared capacity of about 50,000 tonnes per annum.

It may be recalled that the company was served a notice earlier alleging smuggling of PFY capacity and evasion of duties to the extent of Rs. 120 crores. The case came up for hearing on May 14 before the Delhi High court.

ONGC'S PRICING OF GAS JUST: SC

The Supreme Court has held that the natural gas prices charged by the Oil and Natural Gas Commission (ONGC) are "just and reasonable". Setting aside a Gujarat High Court judgement, a three judge divisional bench headed by Mr. Justice S. Ranganathan further held that Oil and Natural Gas Commission prima facie could not be placed on par with a public utility undertaking.

The judges observed that "at this stage of development of oil industry in the country, we think a much wider latitude is permissible in the fixation of prices than the imposition of a 'no profit no loss' basis or a 'cost plus' basis on the producer". The judges said that the fixation of natural gas prices on the basis of alternative fuel cost in the present situation could not be described as irrational or arbitrary.

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Industry wants rifampicin under category-I

Manufacturers of rifampicin, the anti-tuberculosis and anti-leprosy drug want the government to shift it from category-II in the existing pricing regime to category-I, in an attempt to save on excise duties.

Such a demand sounds unusual on the face of it, as category I drugs enjoy a mark up of only 75 per cent under the Drug Prices Control Order (DPCO) of 1987, whereas category II drugs are allowed a mark up of 100 per cent. An intricate logic shows that rifampicin manufacturers will stand to benefit if the drug is shifted to category I. Rifampicin, which was in category I (which covers life-saving drugs used in the National Health Programme) before the DPCO of 1987 was announced, was subsequently shifted to category II after the Bureau of Industrial Costs and Prices declared it as a non-life-saving drug, and wanted to encourage backward integration in its manufacture in the country.

The shift to category II deprived rifampicin manufacturers of the excise exemption available for category I drugs, but this was made up by modvat benefits when they paid excise of 15 per cent on rifampicin formulations combined with isoniazid (INH) and pyrazinamide. But the modvat benefit vanished when the Union Budget this year exempted formulations containing a combination of rifampicin, INH and pyrazinamide from excise duties, while rifampicin manufacturers continue to pay excise on the bulk drug at the rate of 5.25 per cent. At the notified price of Rs. 3,500 a kg for the drug, the excise levy works out to Rs. 184 a kg.

The other important factor is that in any case, most of the rifampicin formulators do not qualify for treatment under category II. This is because the major ingredients in rifampicin-based anti-TB combination drugs are INH and pyrazinamide, which are in category I. Under the existing rule, if the major ingredients in combination drugs are category I drugs, the finished formulation is also given category I treatment when it comes to mark up fixation.

The existing categorisation of rifampicin would help those formulating anti-TB and anti-leprosy drugs as single-ingredient products, but industry sources point out that the internationally accepted effective treatment for TB and leprosy is only with combinations including INH and pyrazinamide. This is backed by the recommendation of the World Health Organisation and the Paris-based International Union against TB and lung diseases.

Of the domestic market for anti-TB and anti-leprosy drugs of about Rs. 100 crores, rifampicin and its formulations alone account for about Rs. 60 crores. The country has about seven manufacturers of rifampicin in the small-scale sector, and two in the organised sector. If the govt. agrees to shift rifampicin to category I and thereby free it from excise, the price to the consumer will fall by about Rs. 400 a kg, according to one leading small-scale manufacturer. But there is another demand from rifampicin manufacturers that will negate the benefit of lower consumer price. They want the permitted price for the rifampicin bulk drug to be hiked from the present Rs. 3,500 a kg to Rs. 3,900 a kg, to offset the impact of the rising US dollar that is making imports of raw materials costlier.

The price of Rs. 3,500 was fixed in November 1988 by the BICP on the basis of a rate of Rs. 16 for the dollar. Importers of 3-formyl rifampicin SV, the penultimate stage product from which rifampicin is manufactured, say that the dollar has since moved upto Rs. 17, and that future contracts for import deliveries around August 1990 are now being fixed at rates of around Rs. 18 a dollar.

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Shortage of anti-typhoid drug imminent

An acute shortage of chloramphenicol, an anti-typhoid drug, is imminent, as most manufacturers of this bulk drug have stopped production over the last few months, on account of unremunerative prices fixed by the government.

While the ministry of petroleum and chemicals has fixed a price of Rs. 1,100 a kg for the chloramphenicol bulk drug, manufacturers at Bombay say that a realistic price would be around Rs. 1,700 a kg. The cost of the imported raw material L-base amino-deol alone works out to about Rs. 1,300, says Mr. K.D. Vora, proprietor of Pune Drugs (India), a small scale unit that has discontinued production since January this year.

Industry sources say that most of the 50 to 60 small scale chloramphenicol manufacturers in the country, who are largely based in Maharashtra and Gujarat, have stopped production. While the small scale units account for a combined production of about 200 tonnes annually, the only two organised sector manufacturers, Boehringer Knoll and Parke-Davis together produce about 100 tonnes annually, but this is almost entirely for captive manufacture of formulations.

The shortage has come at a time when the incidence of typhoid in the country is about to gather momentum. The onset of the monsoons around June usually brings in its wake of spate of typhoid cases all over the country, and the trend continues till December, according to industry sources. It will be only a matter of time before existing stocks with retailers dry up, they say.

Chloramphenicol, which is virtually the only accepted treatment for typhoid is manufactured by small scale units from the penultimate stage of L-base amino-deol, which is imported largely from China, Hungary, Spain and Italy. Parke-Davis and Boehringer Knoll, however manufacture the drug from the basic stage of benzaldehyde, which requires an order of investment in plant facilities that small scale units can ill afford.

The international prices of L-base amino-deol has also been moving up steadily from the $40 to $45 a kg prevailing three years ago to the current $56 a kg. With import duty of 90 per cent (brought down from the earlier 100 per cent in the 1990-91 Union Budget), clearing and processing charges of three per cent, the cost of other additives such as methyl dichloroacetate, and the permitted 14 per cent mark up over raw material prices, the cost of manufacturing chloramphenicol exceeds Rs. 1,700 a kg, according to Mr. Vora. Manufacturers get 1.3 kg of the drug for every kg of the raw material consumed.

Chloramphenicol manufacturers, supported by the Indian Drug Manufacturers Association, have been lobbying with the ministry for higher prices ever since August 1989, when the price of Rs. 1,100 was fixed, but these efforts have not worked. What triggered off the decision by the small scale units to stop production was the issuance of a show cause notice by the ministry to various manufacturers, asking them to remit a collective sum of about Rs. 3 crores, for selling their produce at higher than the notified prices.

Although the notified price was Rs. 1,100 a kg, manufacturers have been selling their produce at rates of around Rs. 1,400 to the 800-odd chloramphenicol formulators in the country. "These formulators were willing to accept these prices because they understood our costing, but they however did not exceed the government-fixed price for the formulations", says Mr. Vora.

It is believed that while senior ministry officials are willing to consider the industry's case sympathetically and grant a higher price for chloramphenicol, the minister, Mr. M.S. Gurupadaswamy refused to concede it. "At this rate, we will have to hand over the keys of our factories to the government," says another leading chloramphenicol manufacturer. "Many of us have shifted over to other drugs such as potassium iodide, sodium citrate and potassium citrate, where the prices available are more reasonable", he adds.

BEE GLUE — THE NEW ANTIBIOTIC?

A glue produced by bees to build their hives appears to contain antibiotic substances that can kill a range of common bacteria.

This has been discovered by two doctors at the National Heart and Lung Institute in London during their study of a large number of plants and plant-derived materials in a search for new anti-microbial agents. In particular, they were looking for a substance to combat a "super but" known as MRSA which is resistant to the present known antibiotics.

The two researchers, Dr. John Grange, a reader in microbiology, and Dr. Ronald Davey, a homeopathic physician, have just reported to the UK Royal Society of Medicine that the bee glue known as propolis could form the basis of the medicines of tomorrow.

They have found that it completely inhibits the growth of MRSA and some other strains of bacteria, and partially inhibits a number of others.

Although it is known that the resinous propolis is derived by bees from plant juices and used to seal openings in their hives, the exact nature of its antibiotic affect has not yet been established. It is thought it is likely to be connected to substances called flavonoids.

Research has shown that flavonoids can help regenerate cartilage, skin and even bone.

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Small PVC leather cloth producers face extinction

The PVC leather cloth manufacturing units in the small scale sector have been suddenly burdened with extremely harsh levies both at raw material stage and end product stage in the budget of 1990/91. Almost all of them who have honestly being paying excise duties will turn sick unless corrective measures are taken forthwith, says Shri Vijay V. Merchant, President, AIPMA in a press release.

The enhancement of excise on paste grade PVC resin (raw material) from Rs. 15,000 per tonne to Rs. 20,000 per tonne adds to the cost of PVC leather cloth for all those using this grade (i.e. basically S.S.I. sector). The large units with sophisticated imported giant plants do not use paste grade in a majority of cases, but make huge quantities of costly leather cloths for the upper strata of society. These have been spared. Hence the burden of this levy is suspension grade PVC resin @40% is

PVC leather cloth excise burden on high cost items vs. low cost items

Large scale	Price without excise duty	Excise duty (127 mm)	Percentage of excise to price
Blossom	74.76	15.24	20.38%
Deluxe	34.76	15.24	43.84%
DA/100 Everlast	94.76	15.24	16.08%
Emperor	49.76	15.24	30.60%
Prestige	50.76	15.24	30.00%
Deluxe	41.76	15.24	36.50%
Tex-O-Hide	62.76	15.24	24.30%

The price range is between Rs. 50 to Rs. 110. The percentage of duty is from 16.08% to 43.84% to the cost of finished product (before excise).

S.S.I.	Price without excise duty	Excise duty (127 mm)	Percentage of excise to price
50 gauge foam	18.56	11.44	61.63%
Book binding	9.80%	8.11 (90 mm.)	82.75%
Printed	16.31	11.44	70.14%
Embossed	10.00	8.11	81.10%

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The government has always as a matter of policy taxed products of high value meant for upper strata at higher rate, and goods meant for common man at a lower rate. In the case of PVC leather cloth ironically, the position is reverse. Low value PVC cloth must have a much lower excise levy if mass needs of book binding, cheap shoes & footwear are to be met. Hence the present of Rs. 12 per meter for DGTD units and Rs. 9 per meter for S.S.I. units needs to be changed.

The table shows that low cost leather cloth varieties of Rs. 9/80 and Rs. 10 per meter are burdened with excise duty which amounts to 81%/82% whereas high cost varieties pay 16%-24% on ex-factory cost of Rs. 95 per meter and Rs. 63 per meter. The S.S.I. units therefore feel this is most unfair treatment would always be ad valorem basis of excise. If this is not possible the S.S.I. units making low cost leather cloth should be subject to Rs. 6 per meter maximum excise as against Rs. 12 per meter for large units, immediately.

Finally, honest S.S.I. units feel if the increasing burden of excise duty is an anti-evasion measure as announced by the Finance Minister, then the reverse is taking place. With higher excise duties on PVC leather cloth, it has become more attractive for tax evaders to dodge duties. The unfortunate fact is those who follow the law and pay full excise will soon be driven out of the market either by the large units (not using paste grade PVC) or the ones who manage to sell without paying duties due to poor enforcement of the department in some pockets of the country.

From the above it will be observed that the excise duty on basic price to S.S.I. units varies from 61.63% to 82.75% to the cost of the finished product. S.S.I. units supposed to be getting benefit of concession are paying heavy excise duty. Leather cloth manufacturers making low priced mass consumer leather cloth in the small sector. If justice is to be done honest leather cloth manufacturers in S.S.I. sector small scale leather cloth manufacturers who are compelled to use paste grade PVC resin which is very heavily taxed should not have such a burden of excise duty on the end product.

GUJARAT WIND POWER PROJECT ON STREAM SOON

A 10mw wind power project, the largest of its kind in Asia, will be commissioned at Lamba in Jamnagar district of Gujarat shortly, official sources said at New Delhi on May 10. The project, which has been completed in less than one year, will provide power to the Gujarat State Electricity Board's grid.

The project has 50 wind turbines of 200 kw capacity each. Twelve wind farm projects with the total capacity of 31.4mw have been commissioned since 1986 in Gujarat, Tamil Nadu, Orissa, Maharashtra, Andhra Pradesh, Karnataka and Madhya Pradesh, the sources said.

Over 23 million units (mu) have so far been fed to the State grids. The annual generation of energy from wind power projects is over two mu per mw, depending upon the site and wind regime. Wind farms could become a source of power generation on a techno-economically viable basis in several parts of the country.

Sites have been identified in Gujarat and Tamil Nadu where large wind farms with sizes ranging from 35 to 55mw could be set up. The Department of Non-Conventional Energy Sources proposes to take up these projects using indigenous capability to the maximum extent possible so that self-reliance can be achieved in exploiting the wind potential in the country for power generation.

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Cheaper import forces polystyrene output cut

Polychem Limited and Hindustan Polymers, the only two indigenous manufacturers of polystyrene have been forced to cut down the production in view of the unfair competition from cheaper imports. The production cut resorted to by the local manufacturers at present is estimated around 30-35 per cent, which would necessitate an additional imports of roughly 10,000 tonnes of polystyrene valued at around $ 10 million. Both the manufacturers have resorted to production cut due to very low off-take and if the government does not raise the import duly suitably on an urgent basis, they fear a complete stoppage of production soon.

The reduction in import duty on polystyrene through a notification No. 15/90 dated February 28, 1990, has resulted in extreme hardship to the local producers. The imported material at the present duty structure is cheaper by about Rs. 9,000 to Rs. 10,000 per tonne than indigenously produced polystyrene. The problem has got accentuated further by the ten per cent increase in the excise duty on local polystyrene in the 1990-91 budget. The total requirement of polystyrene in the country is estimated at around 50,000 tonnes per annum. The indigenous installed capacity between the two plants is 30,000 tonnes and remaining needs are met through imports. The country is already spending foreign exchange valued at $ 20 million on imports of 20,000 tonnes, which is expected to go up to $ 50 million if the local producers were forced to stop production completely.

The problem has arisen as a result of recent reduction in customs duty on the material. There are also some reports of under-invoicing of the material cleared through the Madras Port. "Some parties have imported the material at $ 650 per tonne between October-December 1989, a price which was unheard of in the world," according to inforced sources. Earlier, in September 1987 the government had reduced the import duty on polystyrene from 158 per cent to 74 per cent because of high prices in the international markets. There was a sharp fall in prices in the international markets since mid-1989 when domestic producers represented to the government for an upward revision of import duty. Under the "stock-and-sale" policy, the trade is understood to have contracted for over 15,000 tonnes of polystyrene between July and December 1989 as the price dropped to as low as $ 850-860 from $ 1,500-1,600 prevailing during second half of 1988.

The landed cost of this material inclusive of all import duties was Rs. 26 to Rs. 27 per kg. (Rs. 26,000 to Rs. 27,000 per tonne) against a price of about Rs. 39.30 per kg. for the indigenous material. Of the huge contracted material, about 8,000-9,000 tonnes of imported material at prices ranging from $ 850-900 per tonne was made available in the market during July-December 1989. From January 1990, after upward revision in duty, the large importers kept the imported materials under "bond" and as a result the market prices matched the selling prices of Indian producers. The price of indigenous material has remained unchanged since July 1988.

The price in the international market has improved to $ 1,100 to 1,150 since Dec. 1989 but the importers have not shown much interest in contracting at these prices since about 6,000-7,000 tonnes of low priced material has been cleared from bonded warehouses after the reduction in duty from Feb. 28. From early April 1990, the foreign suppliers, mainly S. Korea, reduced their booking rates to around $ 1,020, which at current level of import duty would work out to a landed price of Rs. 34,000 per tonne against domestic producers' selling price of about Rs. 42,750.

DINOL SHROFF ON STREAM

Dinol Shroff (India) Pvt. Ltd., a joint venture of Dinol AB of Sweden and Shroff Technical Services Pvt. Ltd., has begun commercial production of anti-corrosion chemicals at Tarapur. Dinol holds 20% of the equity of the company set up at a capital cost of Rs. 10 lakhs. Swed-fund of Sweden holds another 20%. Shroffs told 45% and their associates hold the remaining 15%. Dinol AB are world leaders in anti-corrosive chemicals whose applications extend to automobiles, aerospace, defence, railways, offshore installations and industries. Dinol's subsidiaries and agents are operating in over 60 countries and have over 2000 rust proofing stations around the globe. India has become one of the four manufacturing countries in the world, the other three being in Sweden, United Kingdom and South Korea. The product, branded Dinitrol, is mainly targetted at automobiles including the OEM and on-the-road vehicles. Dinitrol is more effective than rubber-based products now in the market which have to be manually applied. Dinitrol is sprayed with guns and hoses designed to reach the minutest crevices in automobile parts.

At present, the following companies are using the product: Mahindra & Mahindra Limited (Kandivli and Nasik plants), Telco (Pimpri and Jamshedpur plants), Eicher Motors (Indore), Bajaj Tempo (Indore) and Premier Automobiles (Bombay) for all its export vehicles. Maruti Udyog is considering the use of dinitrol. Air-India and Indian Airlines are also using the product to fight air-craft corrosion. The Tarapur plant has a capacity to produce three lakh litres, which can be increased as and when need arises. Dinitrol range of products are based on thermoplastic wax and petroleum/polymer compositions which, with multifunctional corrosion inhibitors, seals the metal surface from air and moisture, thus blocking out the elements needed to form corrosion.

A rapid wrap-up of what's new in Operations, Processes and Products

Detergents

In a very recent issue of Chemistry and Industry (1990, No.6, 19 March, p 160-192) P. Hepworth (of ICI) has given an account of heavy duty laundry liquids (HDLL) which now constitute 40% of detergents in USA. HDLL are easier to dispense, have better storage stability and there is no dust or lumping; these are excelllent for synthetic fabrics and coloured garments. The market for HDLL can be expanded by improved formulation and inclusion of bleach.

R Coffey and T. Gudowicz (of PQ Corporation) have discussed the trends in siliceous builders. At present 600,000 tpa of detergent grade zeolite in hydrate form is used worldwide, out of which 340,000 tpa is used in Europe. Zeolite A is now the preferred phosphate substitute. Layered silicates are now receiving attention and these can have different morphologies (rods and platelets).

Vora et al (of UOP, USA) have discussed recent developments in the manufacture of LAB. The UOP Pacol process has been adopted extensively. In 1984, UOP developed a selective hydrogenation process which permitted selective hydrogenation of diolefins which are present in very small amount. Aromatics produced from olefins in the dehydrogenation reactor also react with olefins in the detergent alkylation reactor; new dehydrogenation catalyst DeH 9 offers higher selectivity and LAB yield should improve by 3%. The adoption of CCR is expected to be useful. The use of solid catalysts in place of the hazardous HF has now been announced.

Desulfurization of fuel oil by oxidation and extraction

Tam et al have developed an oxidative - desulfurization (ODS) process to remove sulphur from diesel oils. In the first stage, oxidation is conducted with NO_2 or aqueous HNO_3. Extraction is best conducted with gamma-butyrolactone. Higher extraction yields were realised. A mathematical model is proposed. (*Ind. Eng. Chem. Res.* 1990, **29**, 321; 324)

Technological aptitude (TA) of Brazilian phosphate rocks (PR) fo acid decomposition

Calmanovici and Guilietti have characterized chemically and mineralogically six different PR from northeast Brazil. This was related to their decomposition with nitric acid, hydrochloric acid and sulfuric acid. The degree of decomposition was measured by a specific test referred to as TA test. Aluminium phosphates showed very low reactivity. (*Ind. Eng. Chem. Res.* 1990, **29**, 482)

Absorption method to clean solvent-contaminated process air

Armand et al have developed a new absorption system to purify process air and recover solvents. A new kind of absorber and evaporator are used which are rotary driven. a silicone oil is used as absorbent which is a good solvent for a number of water insoluble solutes like toluene, methylene chloride, butyl acetate etc. Thus, butyl acetate was removed with 95% efficiency and this absorber will be about 3.5m in ht. and about 0.4m dia. This design is useful where space is very expensive. (*Ind. Eng. Chem. Res.* 1990, **29**, 436)

Polymer bound active chlorine

D.M. Emerson has used a sulfonyl chloride form of macroporous cationic resin Amberlyst 15 and treated with an appropriate alkanamine or alkane-diamine in aq. solution at 0°C. A gel type resin of similar type was also prepared from DOWEX 50-X-8. These resins were chlorinated with laundry bleach solution. This resin could remove 99.8% of E. coli at initial concentrations of 10^5-10^8 colonies / 1000 ml. The resin can be regenerated. (*Ind. Eng. Chem. Res.* 1990, **29**, 440)

Gamma Undecalactone (GUL) from omega undecylenic acid (OUA)

Huels has claimed that the above reaction can be carried out with 10-20% (wt) acidic ion exchange resin (e.g. Amberlyst 15) at 100-130°C. GUL is a useful material for perfumes. (E.P. Appl. 293,659, 1987, *Chem. Abstr.* 1989, **111**, 173970)

tert Amyl benzene

Sumitomo Chem. Co. has claimed that a catalyst, based on heating alumina, an alkali metal hydroxide, and an alkali metal, is useful for alkylation of, say, cumene with ethylene to give tert amyl benzene. (E.P. 326,940, Aug. 1989, *Chem. Abstr.* 1990, **112**, 98177)

tert Butyl isophthalic acid

AMOCO have claimed that 3,5 $Me_2 C_6 H_3 CMe_3$ can be oxidised in liquid phase with, say, acetic acid as a solvent at 150-230—C and elevated pressures with Co + Mn catalyst, activated with Br. (U.S.P. 4,827,026, May 1989, *Chem. Abstr.* 1990, **112,** 98205)

4 *tert* Butyl benzyl chloride

Honshu Chem. Ind. (Japan) has claimed that chlorination of 4 tert butyl toluene can be conducted in the presence of azobisisobutyronitrile as a radical generator at 60-80—C. (*Chem. Abstr.* 1990, **112,** 98179)

4,4 Biphenol

This can be produced by debutylation of 3,3', 5,5'-tetra-*tert*-butyl-4,4' biphenol in the presence of activated clay (surface area > 100 m^2/g) at 150°C; diethyl benzene can be used as a solvent. (*Chem. Abstr.* 1190, **112,** 98194).

Na/K nitrophenoxides

High yields have been claimed for reaction of para nitro chloro benzene with aq. NaOH/KOH in the presence of aprotic polar solvents and a small amount of xylene. (*Chem. Abstr.* 1990, **112,** 118449).

Secondary formamides for acetals and formamide

Air Products has claimed that, for instance, diethyl acetal can be reacted with formamide (20:1), in the presence of strongly acidic ion exchange resin Amberlyst XN-1010, to give MeCh (OEt) NHCHO and MeCH $(NHCHO)_2$. (EP. Appln. 332,083, Sept.1989, *Chem. Abstr.*, 1990, **12,** 98034).

1,2,4 Butanetriol

BASF has claimed that hydrogenation of malic acid esters on a CuAl catalyst gives the title compound. (Ger. Offen. DE 3803, 581, Aug. 1989, *Chem.Abstr.*, 1990, 112, 98015).

Man-made Fibers

A recent issue of Chem.Eng. News (1990, 19 March, p.11-14) has covered this subject, including regenerated cellulosics—acetate and viscose rayon. Acrylic fibers are witnessing modifications. A recent trend is the production of polyester microfibers whose use in dense weavers will produce apparel that not only will be waterproof but also will allow the introduction of more comfortable apparel, as microfibers allow the transmission of air and vapour. Polyester filament yarn with microdenier also provides better feel. Allied-Signal has come out with fine-denier nylon which is very comfortable; a branded product Hydrofil is aimed at markets for active-wear and thermal underwear.

New building material

A flexible, waterproof construction material that will solidify in water has been developed by researchers in Japan. It is composed of an asphalt emulsion, cement, and a polymer that can absorb 300 times its volume of water. (*Chem.Eng.News*, 1990, 19 March, p.21).

Membranes for separations

Process Engineering (1990, Jan., p.58-59) has given a brief account of a Conference on Membrane Separation Processes that was held in May 1989. Principal membrane separation processes and devices are : microfiltration; ultrafiltration; reverse osmosis; dialysis; electrodialysis; electromembrane processing; membrane distillation; pervaporation; separation of gases; liquid membranes; ion-specific membrane electrodes; membrane catalysis.

An interesting and useful example is that of cyanide recovery where an iox exchange bed is used to selectively remove cyanides and subsequent recovery with 10% H_2SO_4 as aq. HCN which is then passed through a hollow fiber membrane made of polypropylene to recover HCN via stripping with NaOH. Thus NaCN can be recycled.

Membrane separations can be combined with solvent extraction. Thus tridecanol is used to extract phenol from aq. solution where an emulsion is formed and a membrane is used to filter the emulsion.

Combined extraction/ion-exchange sorption process for separation of phenol containing mixtures.

Larikova et al.have shown that phenol can be extracted from its mixture with p-cresol or guaiacol or anisole with water and aqueous solution can be treated in a fluidized bed of anionic ion exchange resin. Recovery from resin can be done with a suitable solvent. (*Khim.Prom.*, 1989, No.3, p.1715; *Chem.Abstr.*, 1989, 11, 80295.)

Adsorbents for purification of propylene

Molecular Products has developed an adsorbent to remove contaminants from propylene for super purification to give a monomer which is required for highly active Ziegler-Natta catalyst. This adsorbent can remove COS, besides H_2S and RSH. (*Process Eng.*, 1989, Dec. p.22).

Biomagnetic separation for recovery of toxic metal ions

A number of microorganisms precipitate heavy metals onto their surfaces as a consequence of their metabolism and growth. Metal ions like, U, Pt, Pd, Rh, Ru, Au, Hg etc. have been successfully separated through the above process followed by high gradient magnetic separation. (*Process Eng.*, 1989, Dec., p.23.).

Industrial synthesis of optically active compounds

R. Sheldon (of Andeno, Holland) has given an excellent account of this subject. It seems that juxtaposition of catalysis and chirality will emerge as a major focus for research in the 1990s. Pasteur's original work of 1848, where diastereomer crystallization and fermentation were adopted, is still the hallmark. Microbial synthesis continues to be important for "natural" products like L-amino acids, vitamins and hormones. For 'unnatural' products de novo synthesis is not possible and one of the three routes, namely resolution of racemate; chiral pool; prochiral substrates, is adopted. Preferential crystallisation is adopted for alpha-methyl-L-dopa, chloramphenicol, etc. Diastereomer (DS) crystallization is widely used: e.g. Andeno process for the manufacature of DD-(-) phenylglycine, using optically pure camphor sulphonic acid as the resolving agent. We can also have crystallation induced transformation of a DS mixture (e.g. resolution of a series of arylglycine esters with tartaric acid in the presence of carbonyl compounds like benzaldehyde or acetone). A comparison of different approaches has been made for the synthesis of aspartame. Here the fermentation method seems to be most attractive. In the DSM-Toyo Soda process DL-phenyl-alamine is directly reacted with aspartic acid in the presence of enantioselective enzyme.

Enzymes can be used in organic media as long as a very small amount of water is available. The synthesis of optically pure-R-phenoxypropionic acid herbicides via transesterification catalysed by lipase in organic media holds potential.

New breakthroughs in asymmetric hydrogenation, epoxidation, carbonylation, etc. are appearing. Noyori and co-workers have employed chiral metal—Binary complexes for isomerization and hydrogenation. Takasago (in Japan) have reportedly adopted this type of strategy for the production of L-menthol. Here prochiral allylic amine is converted to a chiral enamine. (*Chem. Ind.*, 1990, 2nd April, p. 212; *Speciality Chemicals*, 1990, p. 30).

The need for optically active drugs is opening up a market for analytical equipment. Of 1327 drugs that are marketed worldwide today, 528 are chiral, capable of existing as two or more optical isomers depending on the number of dissymmetric centres. Yet only 61 of the 528 chiral synthetic drugs are marketed as single enantiomers. Principal method of analysis are HPLC (70%), GC (15%) and TLC (5%). The three basic chiral HPLC techniques are derivatization of analyte enantiomers with optically active reagent, use of a chiral column packing and use of a chiral eluting solvent. A chiral dye based on fluororesin has been developed for assisting analysis by TLC. (*Chem. Eng. News*, 1990, **68**, No.12, 19 March, p. 38).

Treatment of wastewater containing organics

The removal of volatile organic materials (VOM) like benzene, toluene, EDC, VC, etc. is often done via treatment with activated carbon. However, it may be more attractive to strip them with air and use carbon beds for removal from the gaseous stream. (Fang and Khor, *Environmental Prog.*, 1989, **8**, 270).

Beck and McCampbell (of Du Pont) have shown that dissolved gasflotation process successfully treats quench water from ethylene plants based on steam cracking of hydrocarbons. (*Ibid*, p N-10).

Trialkyklmethanols from alkenes: use of trialkylboranes and PTC

Trialkylboranes, geaneratead in situ via hydroboration of alkenes, react with chloroform and aqueous sodium hydroxide, to give trialkylmethanols after oxidation with H_2O_2. (*J. Chem. Soc. Chem. Commun.*, 1990, p.323).

Direct hydroxylation of benzene with H_2O_2: Titanium silicate (TS) as catalyst

Ratnaswamy and co-workers have shown that TS works as a good catalyst in converting benzene to phenol (76%) and p-benzoquinone (24%) with 100% selectivity w.r.t. H_2O_2. In the case of Fe-TS, Al-TS, Fe-ZSM5, Al-ZSM-5 the selectivity w.r.t. H_2O_2 was poor. Silicalite by itself does not work; TiO_2 also does not work. (*Applied Catalysis*, 1990, **57**, No. 1 L.-1).

Methyl formate (MF) as a new building block in C_1 chemistry

Lee et al., have given a good review on this subject which refers to the selective formation of MF from CO + H_2 + N_2 mixtures (but CO_2 being absent) and methanol with alkali as a catalyst. Dehydrogenation of methanol with a suitable catalyst can be considered. MF is a ready source of CO via decomposition below 200°C on KCl supported activated carbon; methanol can be recycled. MF can be used to make DMF via reaction with dimethylamine. MF and ammonia give $HCONH_2$ + CH_3OH; $HCONH_2$ can be converted to HCN. MF and HCHO give methyl glycolate which on carbonylation with CO can give methyl ester of malonic acid; chlorination of MF with uv activation gives trichloromethyl chloroformate which can easily give phosgene. (*Applied Catalysis*, 1990, **57**, No. 1, 1-30).

Biotechnology

Biocatalysis in organic media—aqueous two phase system

Halling has given a thermodynamic analysis of selection of solvent. The effective equilibrium constant for esterification reactions is predicted to alter by more than four orders of magnitude on changing between different water-immiscible solvents. The group contribution method was used for prediction. Thus in the case of esterification of benzoic acid with methanol the predicted values of log (K org/K aq.) vary from 1.07 to 5.6 as we go from n-octanol to n-hexane as a solvent. (*Biotechnology Bioeng*., 1990, **35**, 691).

Enhancement of oxygen transfer in aerobic fermentation

Junker, Hatton and Wang have discussed theoretical and experimental aspects of intensification of O_2 transfer by incorporating a second emulsified immiscible liquid (e.g. perfluorocarbons, PFC) which exhibit much higher solubility for oxygen. The Henry's constant in PFC is 20 times that in water and diffusivity twice of that in water. Enhancement factors realised were upto 40 depending on whether water in PFC or PFC in water dispersions were used. (*Biotechnology Bioeng*., 1990, **35**, 578; 586).

Direct production of hydrogen peroxide (HPO)

As is well known, Du Pont have commercialised direct conversion of $H_2 + O_2$ to HPO. This area continues to attract attention from different quarters. Thus, Mitsui Toatsu Chem. have claimed a Pt group metal catalyst on a hydrophobic carrier, such as porous Teflon, which gives high concentration of HPO in the aqueous phase. (Jap. Pat. cited in *Plat Metals Review*, 1990, **34**, p. 55).

Du Pont have a recent patent where the aqueous phase contain H^+ and Cl^- or Br^- + catalyst containing Pt and Pd. (US.P. 4,832,938, *ibid*, p. 54).

Dehydrogenation of cyclohexane with a Pd membrane

Itoh et al have shown that the oxidative dehydrogenation of cyclohexane using a Pd membrane at 200°C under atmospheric pressure and using 10% O -- containing gas as a "sweep" allows 100% conversion although the thermodynamic conversion is only 19%. This is due to the fact that H_2 which permeates is oxidised to water. (*Sekiyu Gakkaishi*, 1989, **32**, No. 1, 47 cited in *Plat. Metals Rev*. 1990, **34**, p. 47).

Platinum group metals in phase transfer catalysis (PTC)

E.S. Gove (of Johnson Mathey) has given a very useful review of this subject where, as of now, the only commercial adoption is that by Rurhchemie for oxo reaction where Rh triphenyl phosphine trisulphonate catalyst which has high water solubility, is used and catalyst recovery is greatly facilitated particularly for higher olefins. PTC can change the course of reaction like in the case of carbonylation of benzylhalide where the product could be $ArCH_2$ COOH or $ArCH_2$ $COOCH_2Ar$ or $ArCH_2$ CH_2Ar. Oxidation of olefins by Wacker type process to ketones is facilitated by the use of PTC. Reduction of benzene to cyclohexane with RH complexes and EDC-water system using Aliquot 336 has been reported. (*Plat. Metal Rev*. 1990, **34**, 2-9).

Multiphase Systems: Fluid dynamics

D.L. Koch (of Cornell, USA) has given a brief account of special problems that are encountered in practice. Thus when a suspension flows through a porous medium where the particle size is comparable to pore dia, the motion of the particles is influenced by nearby pore walls. (This is so even for blood flow through capillaries). The movement of oil drops through a porous matrix is yet another challenging problem in oil recovery. Stability of liquid-liquid interfaces in low gravity environment of a spacelab is a fascinating problem.

A basic suspensions mechanics problems is in the realm of fibre-filled composites where we could be interested in knowing the orientation of suspended fibers during fluid motion. (*Chem. Eng. Prog*. 1989, **85**, No. 11 (Nov.) 74).

Deodorization with direct-fired heater (DFH)

Kuroda and Young have demonstrated that DFH can be used without any adverse effect on the quality of oil. Indeed at least ten commercial units are operating in Asia. A new unit in Taiwan, established in 1986, features a single-shell design and stream-stripping of deep oil layers. (*J. Amer. Oil Chem. Soc*., 1989, **66**, No. 12 (Dec.), 1781).

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Fertiliser output below target

The production of nitrogenous and phosphatic fertilisers during the financial year 1989-90 is estimated at 8.6 million tonnes as against the target of 9.4 million tonnes. The production target for nitrogen was 70 lakh tonnes but during the first 11 months of the year till February only 61.49 lakh tonnes had been produced which was 2.42 lakh tonnes short of the target for the period. The production in the full year is expected to be 68 lakh tonnes only, two lakh tonnes below the target.

The production of phosphates up to February was 16.32 lakh tonnes. The target for the whole year was 24 lakh tonnes. The total production, however, is estimated at 18 lakh tonnes. According to the annual report of the Department of Fertilisers for the year, the capacity utilisation of plants producing nitrogen and phosphates respectively was 82.3 and 65.1 per cent.

Most of the units under the Fertiliser Corporation of India and Hindustan Fertiliser Corporation being old and sick worked at low capacity. In addition to obsolescence and defective design and equipment, the units were also hit by unstable power supply. To improve the power facility, captive units are being installed in these plants. A 30mw gas turbine has already been installed at Talcher unit of Fertiliser Corporation and captive units of different sizes have also been installed at Barauni, Namrup and Durgapur units of Hindustan Fertiliser Corporation.

The report says modernisation schemes are also being considered to remove the difficulties being faced by these units on account of frequent mechanical breakdowns and to improve their operations. A caprolactam-ammonium sulphate plant being set up at Udyogamandal by Fertilisers and Chemicals Travancore Ltd. (FACT) is expected to be completed by June. As a measure of diversification this scheme would help the Udyogamandal unit to improve its operational and financial viability. Besides, additional captive power capacity is being added to the Cochin unit of FACT.

Captive power plants of 30-mw each have been installed at Bhatinda and Panipat units which, though otherwise should, have not been able to reach their optimum production potential due to the recurring and frequent problems of unstable power supply, the report says.

In the new nitrogenous fertiliser plants, captive power units are being built as part of the total project from the very beginning. As for the Eighth Plan, the report says the strategy of making additional fertiliser nutrients available should be to augment domestic production capacity and adopt not only cost and energy effective schemes, but also which have shorter implementation period.

The objective, the report says can be fulfilled by implementing spill over gas based projects of the Seventh Plan along the HBJ pipeline. Plants which are consistently operating at that low level should be revamped. Such revamping, with the incorporation of modern technology to the extent feasible, would ensure significant enhancement of production level from the group of plants whose full potential was never realised due to various constraints. New units should be located where raw material resources such as natural gas have been found and exploited for utilisation, the report says.

OFFERS FOR MCF TAKEOVER UNDER STUDY

The committee of secretaries, headed by the chief secretary, government of Karnataka, is considering offers from five to six companies who have expressed interest in taking over the state's controlling interest in the Mangalore Chemicals & Fertilisers Limited (MCF). The committee will be making an appropriate recommendation to the Cabinet as soon as possible since an early decision is in the interest of MCF.

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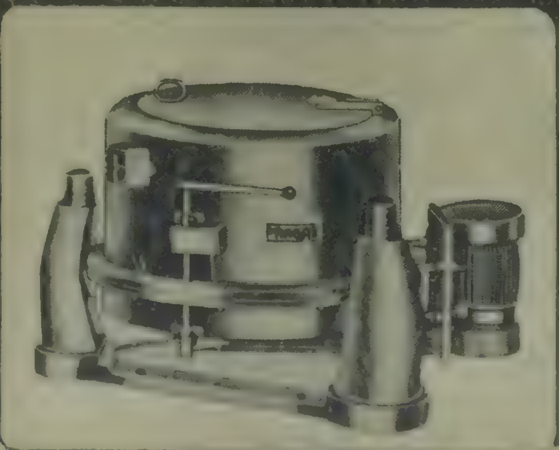

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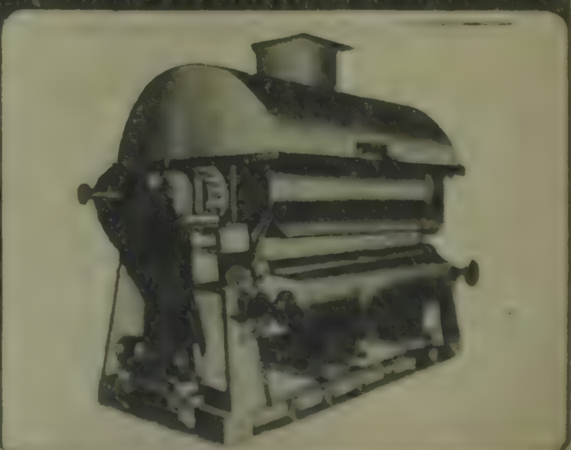

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More fertiliser units facing losses for '89-90

Almost all the seven viable fertiliser units in the public sector would end up in losses by the end of the year 1989-90 except one, says an official document. The units have incurred losses of Rs. 53.02 crores during the first 11 months of the year as against a profit of Rs. 96.16 crores in 1988-89, according to the annual report of the Department of Fertilisers for 1989-90.

During the 11-month period, only Rashtriya Chemicals and Fertilisers Ltd. (RCF) has made a profit of Rs. 25.23 crores. The unit had earned Rs. 69.64 crores profit in 1988-89. The year, however, saw the losses of the two sick units in the sector coming down. In the 11-month period, the Fertiliser Corporation of India Ltd. (FCI) and Hindustan Fertiliser Corporation Ltd. (HFC) have incurred Rs. 291.51 crore losses as against Rs. 347.62 crores in 1988-89, the report said.

The provisional estimates for 11-month period also show that the two co-operative sector enterprises have earned profits during the period. The profits of Krishak Bharati Co-operative Ltd. (Kribhco) was Rs. 39.72 crores and that of the Indian Farmers Fertiliser Co-operative Ltd. (Iffco) Rs. 18.73 crores.

The report said the main reasons for the lower profitability/losses of the units include erosion of profitability due to changes in the retention price norms, shortage of imported phosphoric acid, production loss due to power cuts in Cochin I and Cochin II plants of FACT and Ramagundam and Gorakhpur plants of FCI.

It notes that the shortage of imported phosphoric acid had resulted in the shut down of plants for about five months. The report said during the year while some of the fertiliser units set new records of production and capacity utilisation, the overall production fell short of the target upto February 1990. It is expected that the production of nitrogenous and phosphatic fertilisers would be about 8.6 million tonnes as against the target of 9.4 million tonnes, the report said adding that the shortfall in production as regards phosphatic fertilisers was due to shortage of imported phosphoric acid.

Among the highlights of the year was the first prize awarded to National Fertilisers Ltd. (NFL) for successful implementation of the Vijaipur gas-based fertiliser plant within the approved cost estimate and time schedule. For a similar achievement, Iffco was awarded the second prize for the Aonla project. These awards have been instituted by the ministry of programme implementation.

THERMAL PLANTS' POLLUTION CONTROL STEPS REVIEWED

The first meeting of the National Task Force (NTF) on Thermal Power Plant (TPP) has stressed the need for evolving environmentally sound methods of disposal of fly ash in view of the huge quantity of its generation.

According to a release the first meeting of the NTF was held at New Delhi under the Chairmanship of Mr. M.L. Shishoo, Chairman and Managing Director of Bombay Suburban Electricity Supply, and former Chairman of National Thermal Power Corporation.

The release said implementation of pollution control measures in 68 coal-based thermal power plants was reviewed. It was revealed that 23 units were fully and 19 partially complying with emission standards.

The remaining have neither provided pollution control devices nor submitted any time-bound programme. The Central Electricity Authority has submitted an updated implementation schedule which is under review. It was recommended by the Chairman, NTF, that the Central Board in collaboration with the State Board should visit the industries complying with the emission monitoring to ascertain compliance.

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Experts to assess Chernobyl fall-out

The International Atomic Energy Agency (IAEA) is organising a major project in which a team of independent experts will assess the radiological consequences of the Chernobyl accident in the Soviet Union.

Those agencies participating in the project are the Commission of the European Communities (CEC) the Food and Agriculture Organisation (FAO), the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) and the World Health Organisation.

According to an IAEA press release, the survey will include the health and environmental effects and the protective measures taken by the Soviet authorities. The project follows a request made in October 1989 by the USSR government to the IAEA to organise an assessment by international experts. A preliminary meeting of officials of the USSR, the Ukranian Soviet Socialist Republic and the Byelorussian Soviet Socialist Republic and the IAEA was held in Moscow between February 7 and 9 to outline the plan of action.

An international experts' preparatory mission was subsequently organised by the IAEA to identify the major assessments to be made. The mission included experts from Austria, Japan, the United Kingdom, the U.S., the CEC, the FAO and the IAEA secretariat.

They were accompanied by two members of the USSR parliament and visited the villages of Polesskoje and Ovruc in the Ukrainian SSR, Bragin, Veprin and Korma in the Byelorussian SSR and Novozytkov and Zlynka in the Russian federation, all of them located in the contaminated areas.

The experts reviewed information provided by scientific organisations, hospitals, clinics and agricultural centres, both in the affected areas and in the Republics' capitals. The results of the preparatory mission were presented to an international advisory meeting chaired by Dr. Itsuzo Shigematsu, director of the radiation effects research foundation, Hiroshima, in Japan.

The committee approved the work plan to be implemented which includes the corroboration of data to be provided by the USSR as well as an evaluation of protective measures that were to be taken. It is expected that approximately 100 international experts will start this month, according to the IAEA press release.

The specialist teams will deal with the historical portrayal of the events leading to the current situation, corroboration and assessments of the environmental contamination and of individual and collective dose assessments, clinical health effects from radiation exposure and evaluation of the general health situation and of protective measures, according to the release.

DCL POLYESTERS PLANT INAUGURATED

The Asian Development Bank (ADB) Executive Vice-President, Mr. In Yong Chung visited DCL Polyesters plant at Mouda, near Nagpur recently. He also inaugurated the plant.

DCL Polyesters plant is financed by the ADB. Mr. Chung was impressed by the speed at which the first two spinning lines of the plant had been commissioned. He was accompanied by Mr. Lovraj Kumar, Chairman, DCL Polyesters, and Mr. M.B. Raju, Managing Director.

MANEKA'S CALL TO POLLUTION CONTROL CHIEFS

The Minister of State for Environment and Forests, Mrs. Maneka Gandhi, has asked the chairmen of State pollution control boards to clean up the identified "problem areas" by August 31 this year. A total of 15 such problem areas have been identified all over the country.

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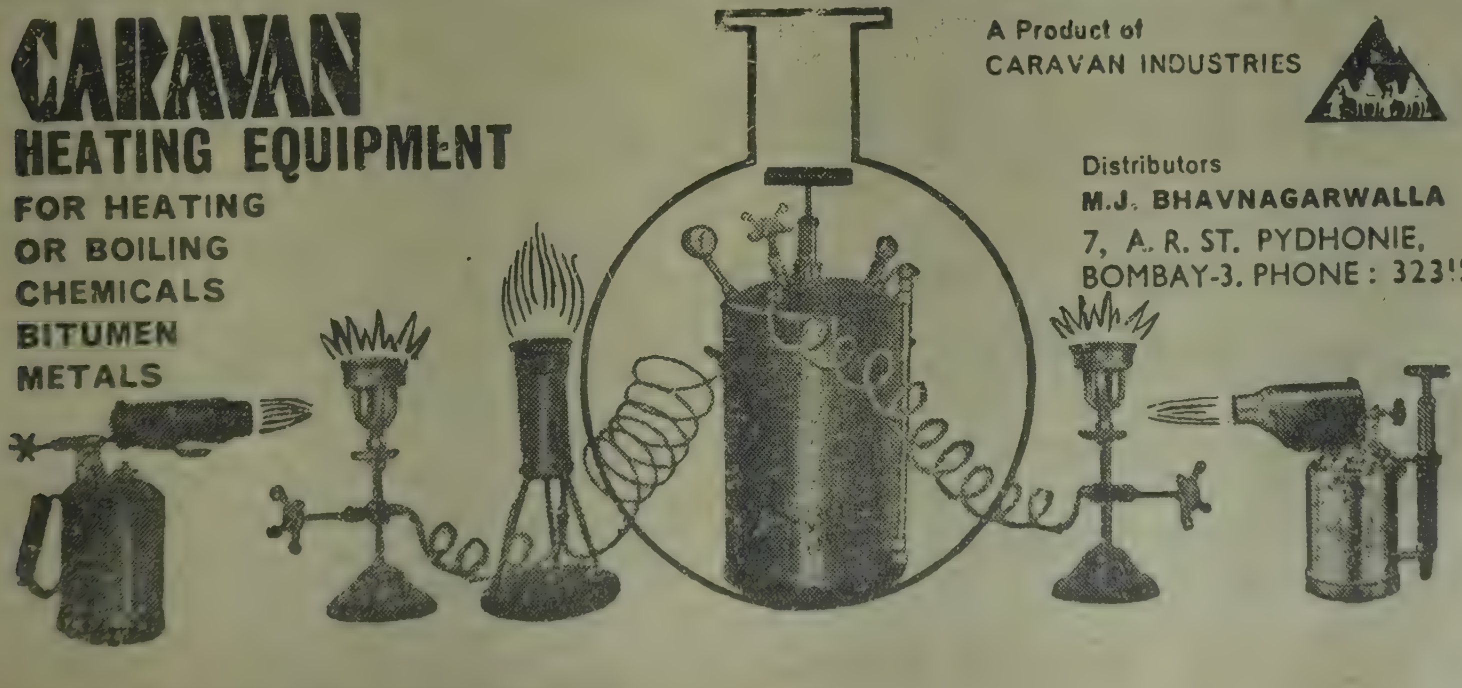

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India wants ILO code to combat health hazards from new technologies

India has sought a further strengthening of dialogue between governments and representatives of the working population from the North and the South in an effort to cope with the challenges emerging from occupational and health hazards posed by advancing technologies, especially in the extremely large range of toxic chemical substances produced by the chemical industry, while participating in an international round table organised at Bonn by the International Labour Organisation (ILO) in co-operation with the German Foundation for International Development.

Entitled "working conditions and the environment", the conference was notable in view of the large number of government officials and trade union representatives from Asia, Africa, Latin America, Europe, the United States and from the Federal Republic of Germany were represented in it, in an exercise that sought to underline the direct link between the improvement of working conditions and increased productivity.

A survey of the last thirty years reveals the uncomfortable fact that while industrialised countries registered a sharp decline in the incidence and severity of industrial accidents, with the rate of fatalities dropping by some 70 per cent, developing countries were characterised by a staggering incidence of work-related deaths and accidents due to workers brought into dangerous contacts with both advanced and obsolete technologies, with inadequate knowledge as to how to effectively deal with them. Mechanisation of agriculture alone has taken a heavy toll on adults and children alike, with increasing risks attendant on sectors such as construction, mines and transport.

Although a proper concern for job satisfaction had led to interesting developments in the field of work organisation and ergonomics had become a discipline of its own, the fact remained that both in developed and developing countries a lot still was not known about the impact of working conditions on the health of the workers and productivity at work. Remarkable strides taken by the medical profession and the media have now created a strong awareness and public concern over such disorders as stress and cancer, and over the harmful exposure to environmental hazards, chemicals and radiation.

The problems of health hazards and environmental pollution in the work environment in the Indian context were highlighted by Mr. H. Ghosh, joint secretary, ministry of labour, who focused on the unorganised and small-scale sectors to make his point that a serious danger existed where employers with limited resources could do precious little in educating, enlightening and protecting their workforce about risks lurking at the workplace. With new technologies being developed at an increasingly rapid pace and their transfer creating assimilation and adjustment problems in the poorer nations, these could not be solved in isolation, he emphasised. It would be quite proper if the ILO takes a lead in the task of classification, labelling, instructions and the like in many areas where almost nothing is in existence, Mr. Ghosh pointed out, and called for the evolution of a uniform system or baseline datasheet to help dissemination not only among developing countries but also in the industrial nations themselves.

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Phasing out use of CFCs will cost India Rs. 20 bn

It could cost up to Rs. 20 billion £770 million for India to phase out the use of the main substances which destroy the ozone layer, a study commissioned by the Indian government concludes. The study could play a central role in a large international conference to be held under the auspices of the United Nations in June. This has been called to strengthen the existing agreement on ozone depleting substances — the Montreal Protocol.

One of the main tasks of the June conference, to be held in London, will be to encourage large developing countries such as India to sign the Montreal Protocol. The protocol at present will commit developing countries to phase out the use of ozone depleting substances by 2020, 10 years longer than the deadline for the industrialised countries.

However, most developing countries have been inhibited from signing because of a lack of any hard data on the costs of the Protocol's commitments. The Indian study, carried out by consultants at Touche Ross and financed by the UK's overseas development administration, fills that gap.

It is highly relevant to one of the issues expected to dominate the June conference — the creation of a funding mechanism for industrialised countries to help developing nations in phasing out use of ozone-depleting substances. Mr. Mahesh Prasad, permanent secretary at India's ministry of environment and forests, said "we are willing to switch away from these substances, provided the incremental costs of substitution can be met".

Without countervailing action, Indian use of ozone depleting substances will increase from about 10,000 tonnes now to 20,000 tonnes in 1996 and 45,000 tonnes in 2010, the study concludes. The study has identified substitutes which could replace ozone depleting substances, particularly chlorofluorocarbons (CFCs), in all the main sectors where they are used by India at present, namely aerosols, air conditioners, refrigerators, cleaning and fire prevention.

One option identified in the study would see India abandoning CFC use in aerosols from 1997 and then progressively reducing CFC consumption in other areas from 2003, with a total phase-out by 2010. This would cost Rs. 14 billion to Rs. 20 billion at 1990 prices. A less demanding option would allow continuing use of CFC's to recharge existing refrigerators and air conditioners, implying a total phase-out by 2020. This could cost Rs. 700 million to Rs. 1 billion by the year 2010. The overwhelming bulk of costs of the first option would fall on consumers, rather than manufacturers, because having to replace refrigerators early and the higher electricity consumption of refrigerators using CFC-substitutes account for most of the costs. These calculations exclude technology transfer costs, foreign exchange implications and employment effect.

MRL FEEDSTOCK FOR TWO MORE PETROCHEM UNITS

The state-owned Madras Refineries Limited will commence on May 18 supply of the essential feedstock to two downstream units that have come up in the sprawling Manali industrial complex. With the formal commissioning of the butane unit at MRL by Chief Minister M. Karunanidhi, the Ceetex Petrochemicals, promoted by the RPG group, will start receiving the butane gas, the input to produce methyl ethyl ketone (MEK). The Kothari Sugars & Chemicals' polybutanes unit is to get the feedstock (isopropylene) from the refineries. MRL chairman and managing director V.R. Deenadayalu, said that the LPG cracker unit, which would turn out butane, had not cost much in terms of investment — only about Rs. 3 crores was involved.

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POLLUTION CONTROL

Australian firms report to SAIL

The Australian combine, Kinhill and BHP Engineering, have almost finalised their report on environmental management and pollution control in all the four plants of Steel Authority of India. They are also submitting a report upgradation of ash content in coal and modifications in the present electrostatic precipitators which are said to be not suited for use of local coal.

Mr. John A. Gillett of Kinhill and Mr. John Clark, the Managing Director of BHP, who were at New Delhi said that the two companies have formed a joint venture in Australia and are considering to set up a company in India with 40% foreign equity. They have not yet finalised the Indian party. No final investment decision has also been made.

Both Kinhill which is a consultancy firm and BHP Engineering, an engineering firm, are at present market leaders in their respective fields in Australia. The chairman of Kinhill Company Mr. Malcom Kinnard had visited India as part of the Australian trade delegation which had come during the visit of the Australian Prime Minister, Mr. Bob Hawke, last year.

According to Australian High Commission sources, the MoU that had been signed on co-operation between the two countries in various fields has made no progress so far as there were elections in both the countries and new Governments have been formed. In Australia though Mr. Bob Hawke had been re-elected, the new Cabinet is yet to consider the detailed implementation of MoU.

Kinhill and BHP in their report to be submitted to SAIL have dealt with ways of reducing the amounts of waste produced in solid, dust and wastewater form and have recommended recycling techniques, including converting solid waste into road fill and other revenue earning uses.

The Australian consultants have criticised the designs of the electrostatic precipitators and particulate collection systems in all the steel plants as they were not designed to Indian conditions.

UN MEET ON OZONE CHEMICALS ENDS IN DEADLOCK

A UN meeting on phasing out ozone-destroying chemicals ended in a deadlock on May 11, with the US at odds with other countries on how to help poor nations finance alternative technology.

The US delegate, Mr. Richard Smith, a state department official, indicated a showdown over the issue was now likely at a ministerial meeting starting on June 20 in London.

"We are all going to have to return to this set of issues in London", he said as the three-day session wound up.

Delegates said Washington joined the meeting's 42 other nations in accepting a unsponsored outline on aid financing as basis for further bargaining.

The text says the financing should be in addition to existing development aid programmes.

"It is basically a good document, it represents progress," Mr Smith said. But he added, "it is not a fully-agreed document".

The UN proposal calls on members of the Montreal protocol to set up a "multilateral fund".

But it left details open and did not mention a proposed 100-million-dollar special fund help developing nations that delegates have been considering.

The 1987 Montreal protocol was adopted to cut the world's use of chlorofluorocarbons, gases used in refrigeration, aerosol sprays and foam blowing.

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Drive to save petroleum

The Government has decided to intensify efforts at conserving petroleum products and their proper utilisation in the country in view of the fact that the share of oil and natural gas as commercial energy has been increasing and their growing demand has to be met by importing these at the cost of foreign exchange.

Since the recent increase in the prices of petrol and diesel has not appreciably curbed the demand for petroleum products, officials feel that intensification of efforts at conserving these has become more imperative than ever before.

According to the annual report of the Ministry of Petroleum and Chemicals for 1989-90, a special cell headed by a Joint Secretary has been constituted for co-ordinated and effective functioning of all the agencies engaged in conserving petroleum products.

The Joint Secretary in charge of conservation of petroleum products has been made Vice-Chairman of the Petroleum Conservation Research Association (PCRA) as also Chairman of its executive committee.

Till the end of the 1989-90 financial year, studies carried out in small industrial units, said 750 kls of petroleum products valued at Rs. 25.5 lakhs were expected to be saved, the report said.

Up to December 1989, 717 follow-up studies in respect of fuel consumed by big industries consuming 250 kls or more fuel annually were conducted. They revealed additional savings achieved (on account of implementation in 1989-90 of the recommendations) in the previous year was Rs. 14.62 crores. By the end of March 1990 petroleum products worth Rs. 18 crores were expected to be saved, the report said.

In the agricultural sector, PCRA continued the programme of rectification of lift irrigation pump-sets in Gujarat, Rajasthan, UP, Punjab and Andhra Pradesh with the help of the agencies concerned. A total of 194 pumpsets have been rectified which save petroleum products worth Rs. 0.14 lakh till December 1989. An estimated 600 pump sets had been rectified at the end of the financial year, the report said.

As an important part of research and development, PCRA has designed a fuel efficient melting furnace which has been installed in the manufacturing unit at Shahadara in Delhi. The project is expected to result in fuel saving of about 15 per cent.

Efforts have also been initiated to explore the possibility of conserving petroleum products in the sectors not covered by PCRA so far. A working group has been constituted to study and make recommendations on conserving petroleum products in the shipping sector.

CENTRAL APPROVAL SOUGHT FOR SETTING EXPORT-ORIENTED PETROLEUM REFINERY

The Gujarat government is seeking the Union government's approval to setup an export-oriented petroleum refinery with a capacity of six million tonnes a year to be located off Saurashtra coast.

This is the project for which the state chief minister, Mr. Chimanbhai Patel, on a visit to the United States and London, is keen on having NRI investments so that the foreign exchange component is taken care of. He has asked the officials to work out a package which will be attractive enough for NRIs to invest in the venture.

Highly-placed sources in the state government are of the view that it will not be difficult to get the approval of the Centre for the project considering the shortfall in refinery capacity which is estimated at 50 million tonnes in the least and 70 million tonnes at the most. It has been estimated that atleast three refineries are needed during the Eighth Plan but the Planning Commission has not yet approved a single one because of resource constraints.

The sources said that it has been estimated that a refinery of six million tonne capacity will require Rs. 600 crores in foreign exchange and this order of funds will not be difficult to obtain if NRIs get interested in the venture. The Centre could have no objection to it since there is no outgo of foreign exchange in implementing the project.

The major advantage is that the foreign exchange outgo on import of petroleum products will come down since the import cost will be fully covered by the export of products.

Additionally, India can have kerosene and diesel which account for substantial part of the import bill on petroleum products from the proposed refinery.

Though a 100 per cent NRI participation in the proposed refinery will be welcome, the project will still be a viable proposition if NRIs pump in Rs. 600 crores equal to the foreign exchange component of the project.

For funding the remaining cost of the project, estimated at current prices to be around Rs. 1,400 crores, local arrangements can easily be made, the sources added.

RANBAXY AWARDS

The Ranbaxy Research Foundation is to shortly to present the 1988 awards for excellence in research in the fields of medical and pharmaceutical science. The awardees are selected by a panel of judges comprising eminent scientists from various fields.

ONGC heater treater plants in Gujarat

For better demulsification of heavy crude in North Gujarat, ONGC for the first time has commissioned a series of heater treater plants in North Santhal near Mehsana. In the process of oil production, water with oil is produced, which is termed as emulsion. The separation of water from oil is a difficult process and is known as demulsification.

The very large sized plants, each having a capacity to handle over 600 cubic metres of emulsion per day, are specially designed to heat the crude upto 130°C. Disclosing this, the spokesman of western region ONGC said at Ahmedabad on May 10, that four such heater treaters have already been commissioned and the fifth one is coming in the Mehsana project.

Crude oil, during production is associated with gas, other basic sediments and water which is known as BSW. For supplying to the refinery, as per the designed specification for further processing into different byproducts like petrol, diesel, gasoline, kerosene etc. it is required to reduce the percentage of water and other basic sediments before the crude is actually handled by the refinery. Apart from fetching higher revenue, a low percentage of BSW also prevents corrosion of the pipeline.

One of the special features of the heater treaters is that they work on dual polarity electrical grids which help in better demulsification. Further, they have a separate chamber for separating gas from oil thereby eliminating the requirement of an additional separator.

Further, to reduce the BSW to the extent of less than 1 per cent, ONGC for the first time in the country, is in the process of setting up a desalination plan to be located near the central tank farm, Nawagam. This plant is likely to handle 6.5 mmt of North Gujarat crude oil per annum before it is sent to the refinery.

ONGC has also recently developed a new technology to reduce the water percentage of crude oil by application of diesel sodium silicate. This technology based on indigenously available chemicals is found to be more cost effective than the earlier practice of diesel cementing squeeze job to reduce water content. This new method is under trial at ONGC fields in North Gujarat.

FIRST STAGE CLEARED FOR EXPANSION OF COCHIN REFINERIES

The Government has accorded the first stage clearance to enable Cochin Refineries Ltd. to prepare a detailed feasibility report for expanding the refinery capacity from 4.5 million tonnes per annum (mtpa) to 6.5 mtpa by installing a separate crude distillation unit and debottlenecking of the existing fluid catalytic cracking unit.

According to the Union Minister of Petroleum and Chemicals, Mr. M.S. Gurupadaswamy, the Indian Oil Corporation proposal for installation of a 75,000 tonnes per annum capacity (tpa) catalytic reformer at the Digboi refinery and a 250,000 tpa catalytic reformer at the Barauni refinery has been approved by the Government.

Installation of these reformers are expected to be completed in 42 months and they are estimated to yield 78,000 tpa of motor spirit at Digboi and 370,000 tpa at Barauni. The lead content in this motor spirit is expected to be less and the production would benefit the eastern region. Speaking at a meeting of the Consultative Committee of MPs attached to the Petroleum and Chemicals Ministry at N. Delhi on May 11, Mr. Gurupadaswamy said the IOC's proposal for expanding the lube stock at the Haldia refinery raising lube production from 162,000 tonnes to 222,000 tonnes per year had been approved.

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ONGC to write off outstanding cost of dry wells

The Oil and Natural Gas Commission (ONGC) may not be the cash cow that it was supposed to be, after all. Following strong objections from the government audit to its accounting policy, the oil giant is now giving in, at least partially, by proposing to write off the outstanding cost of dry wells — Rs. 608.18 crores — in three equal annual instalments so that it is fully amortised by 1991-92.

This could reduce its profit figures —in 1988-89, its profit before tax was Rs. 2,095 crores and profit after tax Rs. 1,602 crores. The cost of dry wells drilled and completed during 1989-90 is proposed to be written off in 1989-90 itself. Such dry wells are proposed to be charged off in the year of completion in future also. Any remaining cost of exploration is proposed to be fully charged off as and when the petroleum exploration licence is surrendered.

The total outstanding cost of dry wells of Rs. 608.18 crores is proposed to be divided into two parts for purposes of charging off in three equal annual instalments. Rs. 543.56 crores is to be shown as cost of dry wells in progress and Rs. 64.62 crores under the 'producing property'. An adjustment of this type, it is argued, will also reduce the tax liability of ONGC for the wells in progress.

The ONGC has also proposed to the income-tax department that it be allowed to charge off completely the cost of exploration on surrendered or abortive areas. However, the pre-tax profits of ONGC will come down correspondingly. The commission is expected to meet towards the end of this month to take a final decision on these and some of the other vexed issues connected with its profits and to finalise its accounts. The last change in the ONGC's accounting policy was made in 1985-86 after a study of the accounting practices of the US oil company Cheveron. The new accounting policy invited objections from the government audit. The objections were that the cost of dry wells was not being charged off in the year of occurrence, non-accountal of co-related equipment required to be added for recovery of reserves and inclusion of category-I reserves (problem reserves) in the recoverable reserves.

ONGC took the stand that the unit accounting is generally an area covered by a licence or lease. Individual wells do not play any role in deciding about the charge off.

Secondly, the investments in the field are taken based on actual booking under fixed assets. With additional investments, the balance of recoverable reserve also increases. As such, the audit objection was unreasonable. Category-I reserves were not probable reserves, particularly when continued production was being obained from fields having only such reserves, the ONGC had argued.

However, these arguments have not been accepted by the audit. ONGC has partially given in by agreeing to charge off the cost of dry wells to the year's accounts. The government directors on Oil and Natural Gas Commission are now pressing the commission to follow the same accounting policy as Oil India Limited (OIL).

AWARD FOR KAPL MD

Mr. P.P. Mandappa, Managing Director, Karnataka Antibiotics and Pharmaceuticals Ltd.' (KAPL) was presented with the national "Indira Gandhi Priyadarshini Award" for his services, in the management of public sector undertakings.

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Gas-based power capacity addition to be moderate

The Planning Commission has shot down the Department of Power's proposal to add 18,060 mw of generation capacity based on natural gas by 1994-95 keeping in view of its availability and competing demands on it by other sectors of the company during the Eighth Plan period.

The Planning Commission instead feels that it may not be feasible to add more than 7000-7500 mw of gas-based power generation during the Eighth Plan. This too is "subject to its being accommodated within the Plan outlay" which is yet to be finalised.

In fact gas-based generation capacity sought to be added by the Department of Power is almost double of what has been suggested by the Ministry of Petroleum and Natural Gas.

The Ministry had recommended a total generation capacity of 9000 mw, including a capacity of 5230 mw already sanctioned by the inter-ministerial group constituted by the Union Government recently to go into the availability and use of natural gas in the Eighth Plan. The gap linkage for this quantity adds to 21.25 million cubic metres per day (mcmd).

The capacity addition of 18060 mw as proposed by the Department of Power will require an additional gas linkage of 20.29 mcmd up to 1994-95. Thus the total quantity of gas which would need to be committed for power sector would add to 41.54 mcmd in the Eighth Plan.

According to the Planning Commission, it would be difficult to accommodate gas linkage of this order without affecting not only the new commitments but also the existing ones for other sectors.

For example in the eastern region, the gas availability projected by the Ministry of Petroleum and Natural Gas is 9.34 mcmd. As against this, the likely availability may be less as per the estimates of the Planning Commission. In view of assessment, it would be difficult to accommodate the 1000 mw gas-based power plant in Assam as suggested by the Power Department.

One of the points raised in justification of gas based power generation by the Power Department is that they have short gestation period and gas-based generation will meet the power shortages, in different regions during 1992-93 and 1993-94.

The Planning Commission feels that it is not certain whether BHEL would be in a position to manufacture and supply the required number of gas turbines within such a short time. If indigenous manufacture is not possible, it would imply large scale imports involving foreign exchange outgo.

Another important issue that has been raised by the Planning Commission is whether gas should be used for meeting the peak load or for base load requirements or for a combination of the two in the generation for each region.

Keeping all these "constraints" in view, the Planning Commission has shot-down the proposal to add 18.060 mw of gas-based generation capacity in the country during the Eighth Plan and has asked the Power Department to prune its plan to less than half.

GASOIL SUPPLY TO INDIA: SOVIETS LOOKING FOR ALTERNATIVE WAYS

The Soviet Oil Export Company has approached major oil companies and traders in Europe and West Asia seeking alternative ways of fulfilling its term contract for gasoil deliveries to India, traders said.

The Soviets are suggesting exchanging gasoil loading in the Black or Baltic Sea against gasoil delivered to India. The exchanges would be barrel for barrel without any provisions made for price differences, traders said.

The Soviet Union is behind in fulfilling its commitments to deliver 1.5 million tonnes of gasoil a year to India. In May alone, the Soviets are supplying 100,000 tonnes instead of the promised 127,000 tonnes, one West Asian trader said.

The Soviets have promised to arrange for the delivery of an extra 40,000 tonnes through the above described exchanges, naming a major oil company as one supply source.

But a gasoil trader at that company said there was no deal with the Soviets because of the unfavourable conditions. Gasoil in Europe has to be at least $5 per tonne more expensive than in the West Asia for the exchange to be profitable, the trader said. But the price difference is rarely that wide, he added.

A Japanese trader who was involved in similar exchange deals with the Soviets, but for delivery into Vietnam, confirms that the exchanges are usually money losers.

R. CHANDRASEKHARAN TO ACT AS CMD OF RCF

Mr. R. Chandrasekharan will officiate as chairman and managing director of Rashtriya Chemicals & Fertilisers Ltd. in place of Mr. R. Venkatesan. The acting chairman and managing director assumed charge as director (finance) of RCF Ltd. effective May 11. He was coordinator-finance and accounts of Madras Fertilisers Ltd. Mr. Chandrasekharan graduated in commerce from Madras University and is a fellow member of the Institute of Chartered Accountants of India.

GAIL to handle entire gas marketing

The Government has decided to bifurcate production and distribution of natural gas. In about a month, marketing of both offshore and onshore gas will be entrusted with Gas Authority of India Ltd. (GAIL). Oil and Natural Gas Commission (ONGC) will continue to be in charge of gas production.

GAIL is currently losing money as there are few takers for gas it is transporting through HBJ pipeline. GAIL has heavily invested in the project and is unable to recoup the investment. The move to give all gas marketing operations in the country to GAIL is expected to improve the efficiency of the organisation.

GAIL, incidentally, has also been entrusted with the task of setting up a gas cracker at Auraiya in Uttar Pradesh. Centralisation of gas distribution with one agency will also remove the current anomalies in pricing. ONGC and GAIL are now charging different prices for gas.

The Maharashtra Government has granted sales tax exemption and certain other reliefs sought by GAIL for the proposed industrial and domestic gas distribution project in Bombay, making the project economically viable. In view of this development, the project is likely to be cleared by the Public Investment Board (PIB) at its next sitting.

ONGC has committed 1.5 million cubic metres per day gas for Bombay project. GAIL will receive the gas near RCF at Trombay. It has envisaged 90km of steel high pressure piping and 2700 km of medium pressure secondary piping, in addition to 1100 km of service lines. The outer limits of the project will be at Dahisar and Mulund. The lines can go up to Thane in the east depending on the load.

The territory will be divided into districts, each district governor distributing about 5,000 cubic metres of gas. By the year 2000, GAIL hopes to replace more than one lakh tonnes of LPG, 40,000 tonnes of kerosene and 1.5 lakh tonnes of fuel oil in Bombay. GAIL expects to give the first connection within 16 months from the zero date. The project, with technical support from France, will cost about Rs. 420 crores.

Addressing a conference on "compressed natural gas (CNG) in transportation organised by Urja and Indira Gandhi Institute of Development Research at Bombay on May 12, Mr. R.P. Sharma, a senior official of GAIL, said that introduction of CNG for transportation will further improve the viability of GAIL's city gas distribution project.

He, however, emphasised the need for a wide infrastructural network for CNG to succeed. The organisers advocated CNG as an alternative fuel primarily for the two cities of Bombay and Delhi. Divergent opinions were expressed by delegates about the cost of conversion of vehicles to CNG, whether a dual-fuel system is preferable to 100 per cent CNG use and the technical feasibility of adapting diesel-run vehicles on CNG.

One delegate made the point that most of the vehicles driven on CNG in countries where CNG is widely used were originally petrol-based. A representative of Hindustan Motors felt that existing CNG engines will require a lot of modifications to adapt to CNG. Another delegate said that even if only major public transport undertakings like BEST and DTC changed to CNG engines, it will mean a lot in terms of saving of diesel and improvement of noxious emissions. Mrs. Jyoti Parikh of the institute recommended CNG in Delhi, Bombay and along the HBJ line.

Many expressed doubts over the viability of CNG as the price, including distribution and compression costs, may prove unattractive. The abatement of pollutants, especially in cities like Bombay, is a major plus point for CNG. It is also questionable whether in a space-starved city like Bombay, petrol pumps can be adapted to dispense CNG, as the minimum storage space for CNG is 15 x 7 metres, for safety reasons. Many engineering companies participated in the workshop, some of them already having tied up with foreign principals for kit conversion and storage cylinder technologies. As many as three representatives of Premier Automobiles were present, but none of them took part in the discussions.

PETROL USE TO GROW 8.4% IN EIGHTH PLAN

Consumption of petrol in India is expected to grow at an average annual rate of 8.4 per cent during the Eighth Plan. The Petroleum and Chemicals Minister, Mr. M.S. Gurupadaswamy, told the Lok Sabha in a written reply on May 15 that consumption of petrol grew at a rate of 10.8 per cent per annum in the Seventh Plan. According to him, prices of petrol in a few developing countries were comparable or higher than those in India. The price of petrol in India is kept high to curb its consumption and facilitate subsidisation of products of mass consumption like high-speed diesel, kerosene and LPG, he said, adding there was no import of petrol during 1989-90.

In reply to another question, Mr. Gurupadaswamy said prices of imported oil under term contracts were now also market related, that is they were fixed according to a formula linked to spot market quotation of crudes heavily traded on the spot market. No additional quantities are at present being bought in the spot market because of limitations of inventory holding capacity, he added. The Minister further said that intensive integrated exploration for oil and gas was being carried out by ONGC with the Soviet assistance in mutually agreed areas of Cambay, Cauvery and West Bengal basins.

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Europe-1992 could spell catastrophe for Third World: report

Establishment of a single European market in 1992 could spell economic "catastrophe" for the Third World, a report published at London warned. Titled "1992 — European wealth, Third World poverty?", the report cited dangers for some African exporters and Caribbean banana producers, in particular, which now have preferential access to the European market.

"The increasing prosperity in the European Community (EC) after 1992 cannot be assumed to bring increased prosperity to developing countries", said the 20-page report. The report, which was prepared by Ed Mayo of the "World Development Movement" at London, covers the commercial aspects of 1992 and their effect on developing countries.

Launching the report at London on May 8, Ann Clwyo, Britain's shadow minister for overseas development and cooperation, called on EC governments to take immediate action to alleviate the risks facing Third World countries due to the European single market.

"It is too easy to assume that if Europe grows, our partners prosper too. But while Europe 1992 creates opportunities, it also poses new risks, particularly to the poorest countries', she said.

"While their traditional trade preferences with individual EC countries are eroded, they will face the greatest difficulties in expanding over 12 nations because they lack the marketing and advertising skills or the funds for direct investment that other countries have", Ms. Clwyd added.

She conceded that some developing countries would benefit from 1992 but "it will be Japan and South Korea, not Africa". As an example, she cited Mozambique, one of the poorest countries in the world, which depends on selling prawns — 40 per cent of its exports — to Europe.

"If Mozambique cannot meet meet the new standards on shellfish set by the EC for the single market, its export industry will go down the tube", she said. "Yet the European Commission is doing nothing to ensure that the single market benefits, rather than harms, Europe's poorer partners.

She said it could be fatal for Europe to underestimate the importance of trade to developing countries. "In 1988, the 188 million they earned from exports to the EC far outweighed the 24 million they received as aid from the EC.

BHEL WINS FIRST EUROPEAN EXPORT ORDER

The Bharat Heavy Electricals Ltd. (BHEL) will for the first time export power equipment to a European country. BHEL has won a Rs. 43-crores order for the supply and erection of two turbines and generators along with auxiliary equipment for the 120-MW Delimara Thermal Power Station in Malta.

The contract was signed at New Delhi on May 12 by the chairman and managing director of BHEL, Mr. P.S. Gupta, and the chairman of Malta's Enemalta Corp., Mr. L.C. Ciantar in the presence of Maltese minister of state for water and energy Anthony Zammit. The order is financed by the Exim Bank and shipments are being handled by the Shipping Corporation of India.

PPIL PLANS EOU AT TARAPUR

The Pharmaceutical Products of India Limited (PPIL) which went public last year, is coming with a 100 per cent export oriented unit (EOU) at Tarapur, a notified backward area in Maharashtra. The unit with an initial installed capacity of 60 tonnes per annum, is expected to go on stream by end July 1990, according to Mr. K. Rayana, managing director of the company.

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FICCI asks government not to tax export incentives

The Federation of Indian Chambers of Commerce and Industry (FICCI) has urged the government not to treat export incentives like cash compensatory support (CCS), duty drawback and profit on sale of import entitlement licences as income for taxable purposes, as it will adversely affect the initiatives of the exporters.

The more "disturbing feature", FICCI says, is that the purported clarificatory amendment made in the Finance Bill 1990 is retrospective in nature in respect of tax on profits on sale of import entitlement licences from April 1, 1962, CCS from April 1, 1967 and duty drawback from April 1, 1972.

In its post-budget memorandum submitted to the ministry of finance, FICCI says that a number of exporters have treated CCS as capital receipt and therefore not eligible to tax. With the proposed amendment such exporters will now be burdened with heavy tax liability which they may not be in a position to discharge.

In case of profits on sale of import entitlement licences and duty drawback there was legal controversy as to the nature of receipt. It would have been better if the government that has waited for so many years to clarify its intention, had waited for a little more time for obtaining the final decision of the Supreme Court.

In any case, FICCI says that there cannot be any justification for making the amendment retrospective as this was against the accepted norms of the government. If amendment has to be made it should be made prospectively from assessment year 1991-92.

FICCI has also suggested that provision of section 80 HHC which allows for deduction in respect of export profits as a proportion of export turnover to total turnover should be extended to the export of minerals and ores. The rationale was that in the case of export of these minerals and ores, the units have to process them to bring about required degree of purity and quality.

Also, to the intellectuals such as scientists, management experts, professors, chartered accountants and lawyers, who earn valuable foreign exchange by rendering their services to foreign enterprises and others, some tax reliefs should be provided as it was in the case of export of merchandise.

SSIs SEEK RAISED CAPITAL LICENSING

Numerous small-scale industries, unlike the large ones, are unable to avail of the benefit of capital goods imports at 25 per cent concessional rate of import duty for updating technology to improve quality of exports as provided in the new Exim policy. Their disability arises from the possibility that any addition of capital goods to their units might raise their total capital investments beyond the ceiling of Rs. 35 lakhs and debar them from the small-scale industry status.

Making this observation in a statement at Bombay on May 11, Mr. Ramu Deora, president of the Federation of Indian Export Organisation (FIEO), has stressed the need to raise the ceiling to at least Rs. 75 lakhs for those small-scale industries exporting more than 50 per cent of their products. He pointed out that the small industries sector accounted for more than 56 per cent of India's exports and that any measure helpful to the sector was bound to give an additional thrust to its export performance.

He pointed out that the Rs. 35-lakh ceiling was fixed more than a decade ago and that the general escalation in the machinery cost and steep fall in rupee value have rendered original concept of small-scale units meaningless. Unless a small-scale industrial unit updated its technology periodically, it could not hope to remain competitive in the world market for long, he said.

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CAPITAL GOODS IMPORT

Intermediate producers allowed duty sops

The Government has decided to allow import of capital goods at concessional duty by intermediate producers. The decision was notified through a public notice (No. 10-ITC(PN)/90-93) dated April 26, released to press at New Delhi on May 11.

In the new exim policy, the Government had allowed only the manufacturer-exporter to avail themselves of the scheme of capital goods import at concessional rate of duty. Under the scheme, the imports would be allowed if the manufacturer-exporter exports three times the value of capital goods imported in four years.

Like in manufacturer-exporter case, the intermediate producers would also be allowed imports up to a maximum c.i.f. value of Rs. 10 crores. The notification adds that the export obligation for manufacturer-exporter and intermediate producers would be said to be fulfiled if the supplies are made in India of indigenous items against duty-free licences issued under the duty exemption scheme and also if the supplies of intermediate products are made to advance licence-holders under the scheme of supply of intermediate products contained in Chapter-XIX of the Exim policy.

However, the applications from intermediate producers for capital goods imports at concessional duty would be considered only if there is a recommending letter from the ultimate exporter. Both the applicant and the ultimate exporter will be responsible for the export obligation, the notification added.

This obligation will be in addition to any other obligation imposed on the intermediate manufacturer or/and ultimate exporter. The indemnity-cum-surety bond shall be jointly executed by both the parties.

Laying down norms for import of capital goods by the manufacturer-exporter, the notification adds that the importer of capital goods should have an export performance of minimum three years. He would be allowed to import capital goods listed either under Open General Licence (OGL) or are licensible and have a direct nexus to the products intended to be manufactured for exports.

Irrespective of the value of imports, 15 sets of applications shall be required to be submitted by the registered office in the case of others to the Office of the Chief Controller of Imports and Exports (CCI and E).

The importer would also be required to furnish a bank guarantee which would be equivalent to the full value of the duty saved under the scheme.

ANIL CHEMICALS

Anil Chemicals Ltd. has bagged a five-year contract from Coal India Ltd. for the supply of bulk explosives for their existing bulk explosive plant located at Waidhan and also an additional five-year contract for their new plant located at Gervra near Korba. The Gerva plant is expected to commence production by June 1990. The contracted prices for these orders are about 30 per cent higher and since the contract has in built price escalation clause, would ensure consistently good profitability for coming years. The profitability of the company hopes to improve due to higher value addition from prilled ammonium nitrate to bulk explosives owing to finalisation of the contract as earlier the prilled ammonium nitrate was sold against tough competition. The company has reported excellent working results for the year ended March 31, 1990.

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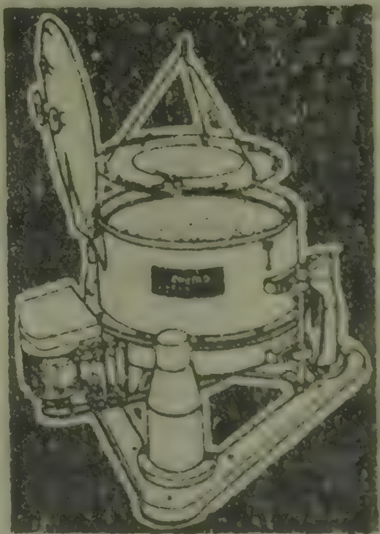

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Integrated sponge iron complex at Raigarh

Indigenous technology is likely to receive a major boost with the Delhi-based Jindal group's plans to set up an integrated complex in Raigarh which will manufacture six-lakh tonnes of sponge iron, one lakh tonnes of pig iron, five-lakh tonnes of hot rolled coils and 40,000 tonnes of ferrochrome — all at a cost of a mere Rs. 153 crores. According to projections, the Jindals will have the lowest cost per tonne of iron in the country.

According to Mr. Ratan Jindal, joint managing director of Jindal Strips, the pig iron, ferrochrome and sponge iron plants will go on stream by the end of the year while the HR steel unit will go into production in March 1992. "Everyone is apprehensive about our claims but it wont be long before the complex would be there for everyone to see", says Mr. Jindal. The Jindals are expected to offer their technology for turnkey projects to other Indian businessmen.

The Jindals have developed sponge iron technology to suit Indian conditions at its 15,000 tonne test plant in Hissar. The plant has withstood several tests in the last two years. This technology is now being scaled up for commercial production, says Mr. Jindal. The sponge iron project will utilise fully indigenous machinery, which, Mr. Jindal estimated, would save around Rs. 250 crores in foreign exchange. The cost of the project has been estimated at Rs. 60 crores. It has been calculated that indigenous capital goods would cost, by a rough yardstick, Rs. 20 per kg as against Rs. 100 for imported goods. The group has already acquired 763 acres of iron ore site in Orissa while coal supply has been tied up with the CIC mines in the Jharkand area.

As far as the HR coil plant is concerned, import content will be limited to two submerged arc furnaces, with continuous slab as well as bloom casting facilities. Some of the drawings for capital equipment would be provided by Mannes Demag of West Germany. The sponge iron will be fully utilised by the HR coil plant. The cost of the project is Rs. 50 crores. Indigenous knowhow from the Jindal's existing ferro chrome outfit would be used to run the new unit in Raigarh. Except for some critical equipment, the rest of the capital goods would be indigenously manufactured. The cost of the project is Rs. 15 crores.

Incredibly enough, the cost of the one lakh tonne pig iron plant has been placed by Mr. Jindal at Rs. 10 crores. Another Rs. 20 crores will be invested in a second hand 45mw power plant which will be utilised to power critical equipment in case of power breakdowns. Cost of power generation is expected to be further brought down by using waste heat from the plants to fire the turbines. By this method cost of generation will be a fraction of usual costs.

The Jindals have also worked out financing patterns for the complex. The Rs. 153-crore complex will be funded by around Rs. 125 crores of premium-based convertible debentures while the rest will come through internal accruals. Expected turnover from the complex is Rs. 500 crores by 1993-94. On account of zero or little interest burden and low depreciation, the differential between gross and net profits wont be much, and cash generation is expected to be in the region of whopping Rs. 100 crores.

Mr. Ratan Jindal claims that the group's track record should provide credibility to his claims about the Raigarh complex. The Rs. 400-crore group is involved in the manufacture of steel strips and plants, ferro alloys, steel pipes and tubes including large diameter submerged arc welded pipes for oil and gas transportation, cold rolled steel strips, aluminium sheets, paints, tea, etc. Mr. Jindal says that the group has several firsts to its credit, including the first 100 per cent indigenous pipe mill in the 60s, the first indigenously designed convertor for refining stainless steel and the first to put up a 100 per cent indigenous ferrochrome plant in the country.

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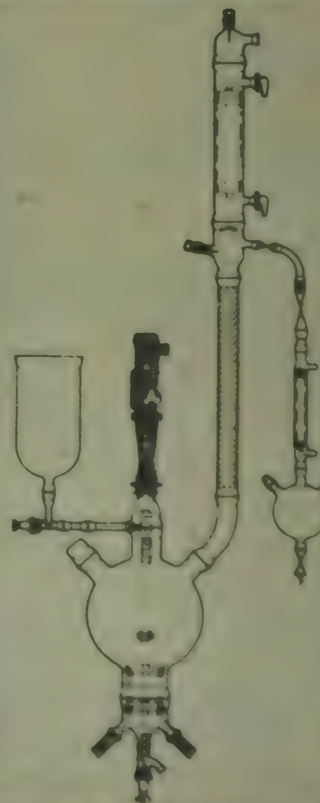

SPOTLIGHT ON

Biotechnology & Life Sciences (Part 2)

PHANEROCHAETE CHRYSOSPORIUM — A VERSATILE ENZYME MACHINE

Phanerochaete chrysosporium (Phc) is a filamentous white wood-rotting fungus and a member of the Basidiomycetes, the class of fungi which characteristically produce toadstools as their fruiting bodies. PhC excels at degrading the cellulose and lignin components of wood. Lignin is particularly difficult polymer to degrade, but it is broken down by ligninases produced by white rot fungi (PhC).

Cellulose degradation generally provides the primary substrtate for the growth of these fungi and only when certain conditions prevail does PhC degrades lignin via a secondary metabolic cycle. The remarkable versatility of PhC in solving problems ligninases. Yet despite this they can also degrade pollutants such as DDT and PCBs, which are not presently known to act as substrates for lignin peroxidases.

Ligninase is a mixture of two types of peroxidase: lignin peroxidase isoenzymes and manganese dependent peroxidase isoenzymes. Together, these extracellular enzymes catalyse one electron oxidation of lignin to an aryl cation radical. This then undergoes cleavage and further oxidation to benzylic alcohols and aldehydes. The enzyme oxidases polycyclic aromatic hydrocarbons to quinones, thus anthracene is converted to anthraquinone. Fungal ligninase will oxidise aromatic substrates with ionisation potentials as high as 7.6 eV, making it significantly more oxidising then the classical horse radish peroxidase.

PhC produces at least ten extraceullular haemoproteins, of which about half have ligninase activity. Lignolytic fungi use the only eucaryotes so far known which are capable of cleaving fused-ring aromatic hydrocarbons.(*Chem & Ind.*,1/15/90, p. 35).

HARNESSING FUNGI FOR ALTERNATIVE BIOTECHNOLOGIES

Fungi are traditionally grown in the laboratory on agar media or in liquid culture, while industrial production of fungal biomass and products involves the use of surface or submerged fermentation. Such technology is ideal for the production of primary metabolites such as citric acid and secondary metabolites like antibodies. However, alternative approaches are generally needed if fungi are to be successfully used in alternative biotechnologies. Mention has already been made in literature of the use of rotating disc fermentation, in which fungi on discs are continually in contact with the liguid under treatment (The Filamentous Fingi, Vol IV London, Arnold 1983, 145).

This approach relies upon the fact that fungi are particularly good at growing attached to surfaces, a property which is put to good use in rotating or static fermentors in which fungi are grown on cords which are kept static in columns or rotated into the solution undergoing treatment. The diverse applications of solid state cultivation of fungi are already under active study. At its simplest, this approach merely involves growing wood decomposing fungi on wood chips, although a more sophisticated approach has recently been reported by Considine et al (Biotechnology techniques 1989, 3, 85). In this case, fungi are grown on agricultural, industrial, or domestic wastes inside plastic bags under conditions of controlled aeration, humidity and temperature. Finally, fungal mecelium or spores can be immobilised onto a variety of inert supports, and in this form exposed to a pollutant. A good example of such an approach is provided by Anselmo et al who showed that phenol could be effectively degraded (Appl Microbial 1989, 13, 200) by using spores of Fusarium floceiferum immobilised on porous celite beads.(*Chem & Ind.*, 1/15/90 p. 32).

MICROBIAL METAL INDUSTRY POISED FOR GROWTH IN USA

Recent attempts to use microorganisms in mineral technology have generally employed chemo-lithotrophic bacteria (i.e. those that gain energy from an inorganic chemical oxidation while obtaining their carbon needs by fixing (carbon dioxide) such as Thiobacillus thioxidans and T. ferroxidans. The effectiveness of these bacteria in solubilising metal ores has led to their widespread use in leaching technologies. By the year 2000 A.D. the 'microbial metal industry' will be worth some $ 90,000 million in USA alone.

Since heterophilic microorganisms require an organic carbon source for growth and energy generation, fungi when it comes to leaching ores, are generally not as useful as are chemolithotrophic bacteria. Despite this, fungi have been used to leach iron from oxide minerals like limonite, geothite and haemetite. The best results are produced by those fungi which convert the added carbon source to citric and oxalic acids. Aspergilus niger has also been used to leach iron from quartz sands, clays and kaolins. This process can be efficient enough to reduce the iron content of some kaolins by as much as 50% leading to a marked improvement in levels of whiteness, a critical factor in their use in the porcelain and paper industries. Organic acids production by fungi can also be applied to the leaching of aluminium, manganese and titanium from minerals and rocks, copper from sulphite ores and nickel from laterite ores. (*Chem & Ind.* 115/90, p. 33).

COAL SOLUBILISATION BY FUNGI LOOKS PROMISING

The conversion of coal to liquid of gaseous products by thermochemical means suffers from the major disadvantage of requiring operating conditions involving high temperatures and pressures. Microorganisms in contrast can solubilise coal at near ambient temperatures and pressure. Fungi are particularly effective at solubilising low ranked or heavily weathered (oxidised) coals. Two mechanisms of biosolubilisation appear to operate. One involves the enzyme-catalysed cleavage of carbon-carbon bonds, while the other involves solibilisation following the production of alkaline materials, which increase the pH of the growth medium.

A wide range of fungi can solubilise coal, but since low grade coals have structures similar to lignin, it is not surprising to find that they are particularly amenable to attack by white rot fungi (p. chrysosporium). These organisms produce ligninases or laccases that use hydrogen peroxide or molecular oxygen respectively to cleave oxidatively the carbon-carbon bonds of an aliphatic chain bound to an aromatic nucleus.

Recent studies have shown that the presence of metal ions in the coal can dramatically reduce the rate at which it is solubilised. As a result organisms which can solubilise coal and accumulate metal ions simultaneously are likely to be particularly effective in converting solid coal during surface growth, or when grown with pulverised coal in submerged culture, as for example, on fluidised bed contractors.

Under optimal conditions, complete solubilisation takes about a week, forming a clear to black liquid consisting of a complex mixture of primarily polar solutes. These solutes are organic compounds of moderate to high molecular weights, which exhibit a considerable degree of aromaticity. The product has potential both as a chemical feedstock and as a substrate for further microbial modification to a fuel gas. (*Chem & Ind.* 7/18/90, p. 32).

BIOTECHNOLOGY COMBATS WASTE IN USA

Biomass Communications Co. Inc., Norwalk, Conn, calls biotechnology an 'old technology with many interesting new and advanced ramifications'. According to the company, the USA generates 145 millions tons of municipal wastes each year. Nearly 65% -including paper, and food waste — is easily biodegradable, and another 16% — rubber leather and plastic waste —is potentially biodegradable.

The biotechnology management market accounted for $ 823 million in 1989, excluding research and development which totaled another $ 144 million. Landfarming is the largest market, worth $ 400 million, but it has been used for decades and shows little growth. Biomediation of hazardous wastes is relatively small, $ 30 million in 1988, but it shows the fastest growth and should react $ 50 million in 1990. Solid waste composting totaled $ 109 million in 1989 and should grow to $ 150 million by 1995. Treating pulp and paper effluents and cleaning up oil spills and leaks form underground storage tanks offer other promising market for biotechnology.

Most microorganisms used in biotechnology occur naturally, but proprietary microbial cultures where a $ 24 million market in 1989 and should be worth $ 60 million by 1995. Microbial treatments even convert waste into energy.

Old municipal waste dumps are being mined for methane in USA as well as Western Europe and the firm expects municipal waste to eventually be converted into fuel without being incinerated.(*CMR 1/1/90, p. 25*).

SUPERIOR ALKALINE PROTEASES FOR LAUNDRY DETERGENTS DEVELOPED BY GENEX CORPORATION

Genex Corp (USA) has been doing research for several years to develop genetic engineering technology in the area of improved alkaline proteases for use in laundry detergents. Thus research has combined the isolation of novel alkaline proteases from natural sources, their modification by protein engineering and the high level production of alkaline proteases using genetically engineered strains of B. subtilis.

This research proved prodcutive and have produced alkaline proteases with 'superior' characteristics for detergent applications, including high specific gravity, stability at high alkaline pH and heat stability. These 'engineered' enzymes are current in applications treating in conjunction with Lever Brothers in liquid detergent formulations. Recently Genex Corporation has entered into a licensing agreement with Lever Bros. (in USA) covering the use of Genex proteins in Lever Brothers products. (*CMR*, 1/15/90, p. 15).

A RAPID TEST KIT FOR DETECTING AIDS INFECTION MARKETED BY BRITISH BIO TECHNOLOGY LTD.

British Bio-technology Ltd., (BBL), the UK based health science company has launched a rapid test kit for detecting AIDS infections.

The new assay technique, called 'Speed Screen HIV' can distinguish HIV-2 from HIV-1 infection, which is important because HIV-2 is believed to be a less virulent form of the AIDS virus. The assay also detects antibodies to novel components of the common HIV-1 virus which may help predict the course of infection and improve patient care. 'Speed Screen HIV' is based on a technology proprietary to BBL which evolved from basic research at Oxford University, the right to which have been assigned to British Bio-technology Ltd.

The Company's general manager Dr. Martin reports that ' Speed Screen HIV' is a rapid cost effective AIDS test which has been extensively tested in a number of clinical laboratories in the UK and has performed well. Not only is it highly reliable, but it also detects antibodies present early to the disease.

The Company expects it to be used to confirm results of current AIDS tests and anticipate that it will also prove advantageous as a primary test in situations.

The kit permits simple, rapid testing of body fluids for antibodies to several different components of HIV-1, p-24 and nef, and for antibodies to the gp36 protein of HIV-2, all in one asasay. Speed Screen HIV' uses genetically engineered viral antigens in particulate form such that the antigens are displayed in a concentrated form which is particularly reactive with antibodies. The versatility of this technology is being further exploited to develop other rapid specific diagnostic assays.

British Bio-technology's Laboratory Products Division manufacturers and markets molecular biology reagents for biomedical research and diagnosis. Its research products are sold worldwide and include a unique range of synthetic DNA genes marketed as 'Designer Genes'. (*CMR 1/15/90 p. 19*).

AN UPDATE ON ICI's AGRO-BIOECH RESEARCH

The focus of ICI's seed research is directed towards developing pesticide and herbicide resistance crops: Closest to the market are corn strains resistant to the European corn borer and corn root worm, two of the major threats to corn. These improved strains are expecting to reach the market in the mid 1990s. 'The difficulty is not identifying the gene, but in the ability to get DNA introduced into the corn to come through in the seed' reports Bill Rathmell of ICI Agrochemicals.

On the longer term, ICI is also looking to develop crops with improved resistance to drought and cold, and to soils with high salt and aluminium contents. ICI (Australia) is also to fund research into the control of the bollworm, which causes $305 million damage to Australian cotton and other agricultural crops.

The firm is granting Aus $560,000 over three years to the Commonwealth Scientific & Industrial Research Organisation (CSIRO) to support development of a species-specific killer virus. CSIRO researchers have already identified a gene that will make the virus lethal to the insect's larvae. (*ECN*, 3/5/90, p. 27).

ICI'S BIODEGRADABLE PLASTIC 'BIOPOL' UNDER TEST MARKETING STAGE

ICI (UK) has recently decided to test market its biodegradable plastic Biopol in 1990 in the cosmetics field. This plastic which comprises polyhydroxy butyrate (PHB) made by the Alcaligenes entrophus bacterium in response to nitrogen deficiency, is produced by a fermentation process at Billingham (UK).

Biopol will be expensive compared with conventional plastics, when the process is commercialised in future, the price is expected to come down to 'three to five times that of conventional polyethylene'. The first uses of Biopol are expected where price is less important than the ability to biodegrade.

For a lower cost products, ICI is also looking at the possibility of blending Biopol with conventional plastics. Another cost cutting option would be to manufacture the PHB in seeds. Preliminary lab work is underway. (*ECN*, 3/5/90, p. 27).

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INDUSTRIAL ENZYMOLOGY: A LOOK TOWARDS THE FUTURE

Recent advance in r-DNA technology, protein engineering and process development have begun to influence the industrial enzyme market is a very positive way. The last episode of growth in market occurred in the early 1960s, with the introduction of enzymes such as glucoamylase for starch hydrolysis and later in the 1970s, when the development of encapsulated products allowed the reintroduction of enzymes into detergents.

The current world market for industrial enzymes is approximately $600 million (sales value), more than half of the market is in USA. Refer table 1.

It is evident from Table 1 that only a small number of enzymes are used in large volumes. In recent years, research has greatly enlarged the range of r-DNA-derived enzymes. These breakthrough will greatly augment the industrial enzymology in future.

Table 1
Worldwide enzyme market

Enzymes	Market $ million
Alkaline proteases	150
Neutral proteases	70
Rennins	60
Other proteases	50
Isomerases	45
Amylases	100
Pectinases	40
Other carbohydrates	10
Lipases	20
Others	55
Total	600

Advances in r-DNA techniques, enzyme engineering, fermentation and process recovery will continue to both lower the cost of enzymes and to improve the enzymes' properties. This may extend the market for enzymes. For instance, the use of cellulases for processing biomass, has until now, been limited by enzyme costs, suboptional ratios of activities and low specific activities.

Improved characterisation of this multi-enzyme system development of DNA mediated transformation systems for filamentous fungi, and enzyme engineering have revitalised interest. The use of enzymes for the synthesis or biotransformation of compounds, such as peptides for the pharmaceutical industry or novel fats and oils for the food industry, will be helped towards commercialisation by protein engineering, which enables enzymes to function more efficiently in organic solvent systems. Newly isolated enzymes and those developed through protein engineering will open up further applications. (*Trends in Biotech*, 12/1989, pp. 330-335).

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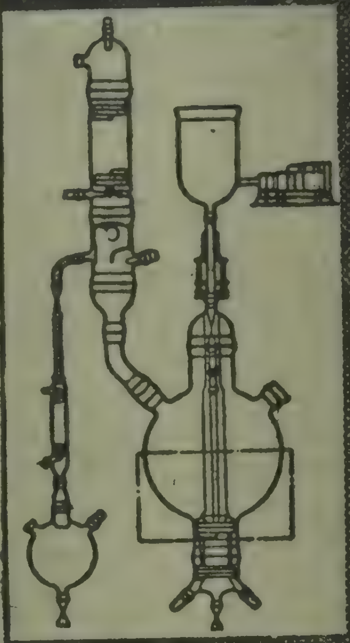

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Science Briefs

CMC: MATERIALS FOR THE FUTURE

The development of a new class of materials called ceramic matrix composites (CMCs) is expected to significantly change the structural and electrical materials markets in the coming decade, reports "GEC Journal of Research". CMCs are composed of ceramic, glass-ceramic and glass matrix materials which contain secondary phase inclusions. These inclusions can be continuous fibres, whiskers, platelets or particulates. In a good composite the inclusion phases(s) synergically interact with the matrix to yield a material with properties superior to either the matrix or inclusion alone.

Glass, glass-ceramic and ceramics offer a combination of structural and electrical properties not available in other materials. These materials are generally hard and possess good compressive strengths. They are less dense than the majority of structural metals. In addition, they are electrically and thermally insulating, refractory and resistant to chemical attack and air oxidation.

At present, the use of glass-ceramic and ceramic materials in structural applications is limited, in part, because of their susceptibility to catastrophic brittle failure, low fracture toughness, flaw sensitivity, for example scratch damage, and their relatively low tensile strengths.

A group of researchers at a private firm in Stafford, United Kingdom, has succeeded in fabricating CMCs with impressive mechanical properties, by incorporating secondary phase inclusions into glass, glass-ceramic and ceramic materials. This has improved damage tolerance, reliability and higher strengths both in flexure and in tension, the journal said.

With the incorporation of these characteristics, it is possible to design machines and structures with these materials having increased reliability, lower mass, longer operational lives, increased efficiency and safety.

Unreinforced structural ceramic with greater flexural strengths are also in the process of being developed. A major influence upon composite properties is the shape of the secondary phase inclusions. Composites containing continuous fibres are potentially stronger and tougher than those containing particulates. Composites containing whiskers and platelets can be considered to be transitional between these two.

In the case of continuous-fibre-containing CMCs, to obtain maximum benefit from reinforcing fibres they need to be aligned parallel to the direction of applied stress. Where a three dimensional stress field is to be applied to the composite in operation, the fibres are required to be arranged accordingly. Researchers are generally laying emphasis on the development of component fabrication technology coupled with design techniques. This is with a view to achieve optimum fibre distribution and orientation within the composite for a particular component application, the journal said.

A large potential exists to fabricate continuous fibre reinforced CMC components by application of good composite design techniques with structural mechanical properties superior to unreinforced ceramic materials. With an emphasis on fabrication, the Stafford researchers have also developed a composite technology suitable for fabrication of complex-geometry continuous-fibre-reinforced components. The technology employs liquid chemical precursors to glass, glass-ceramic and ceramic materials. The processing and physical properties of these liquid chemical precursors are similar to those of organic polymers. They can be frequently converted into dense glass, glass-ceramic and ceramic materials without involving a high temperature melt procedure.

The potential applications of CMC are diverse. They can be used, for instance, in fire walls/thermal barriers, electrical fixtures, sound dampers, brakes and body armours. However, no single CMC is suited to every potential application and in this sense they are like metals and plastics.

Most importantly, they offer potential use in high performance applications to yield products which were not technically possible until recently or were economically unattractive, the journal said.

-- P.T.I. Science Service,
April 16-30, 1990

NEW MATERIALS WILL SPEED BONE HEALING

Researchers at the Liverpool Institute of Medical and Dental Bioengineering in north-west England are developing a technique for using artificial bone materials that will "melt" in the body as its own bone tissue grows and heals.

The work at Liverpool gives promise of the body being able to reabsorb the artificial bone at the same rate as its new bone tissue grows in the man-made material, leaving the patient entirely with his own tissue.

The institute researchers say the techniques they are developing to achieve this should offer major advantages in treating bone defects. The main problems they are working on are biocompatibility, and tailoring of the absorption rate of calcium phosphate-based materials to the growth rate of natural bone.

The Liverpool team is studying materials based on phosphate. Being porous, like bone, they allow the growing bone's fibrous tissues to embed within the artificial bone before the latter is reabsorbed. A researcher explained: "We are carrying out culture studies on appropriate materials for tissue compatibility".

Such materials are being used experimentally in animals but their absorption rate and biocompatibility in humans have yet to be established. Two artificial bone materials have been found to be effective in helping bone healing in animals and there are hopes that human trials with them will begin within the next three years.

Such materials would be injected in liquid form into bone damaged areas such as a fracture site that is not healing. In animals, their use is greatly increased healing and normal bone and marrow had successfully grown across a 1.5 cm fracture.

-- P.T.I. Science Service
April 16-30, 1990

PETROLEUM WAX WITH WOOD PULP IN PAPER MAKING

A group of Egyptian researchers has prepared sheets of paper by treating bleached soft wood pulp with various concentrations of two types of petroleum wax (paraffin and microcrystalline). Paper made this way were found to have improved strength, stiffness and water resistance. The addition of polymers to wax also improved mechanical strength and reduced penetration of water, reports the journal "Research and Industry".

In industry, petroleum wax is used in packaging and, as such, have to conform to certain specifications. Their main function is to restrict the passage of water vapour to and from the content of the package. Finished paper may also be impregnated or coated for similar effects, as well as to provide protection against fats, grease and moisture for such producers as drinking cups, ice-cream and book covers. The addition of additives to the wax improves its mechanical strength and reduces penetration of water and fat. Small proportions of microcrystalline waxes in paraffin waxes considerably improve its flexibility.

Mixing of petroleum waxes to the wood pulp fibres lower the folding endurance of papers from 480 to 320. This effect varies with types of waxes and their concentrations. Higher concentrations of paraffin wax lower the folding endurance of the paper by about 60 per cent. The folding endurance is reduced to 15 per cent by adding one per cent of each polymer. The polymers have less effect than petroleum waxes because non-normal paraffins are more flexible.

-- P.T.I. Science Service,
April 16-30, 1990

MEASURING SAND MOISTURE

A Japanese company has developed a moisture meter that employs electromagnetic waves to measure the amount of moisture in sand. It can also be used to measure ocean sand containing salt and alkali, reports the journal "Prism". This system is installed at the bottom of a sand storage bottle. When the sand is irradiated with electromagnetic waves, a displacement current is generated, which is detected by a meter to measure the water content.

The results are then calculated to determine moisture ratio which is displayed digitally. During measurement, the unit applies pressure to the sand, so it can measure the ratio instantly and continuously. Since the system performs measurements so quickly, it facilitates swift adjustment of product specifications and eliminates trial and error procedures.

-- P.T.I. Science Service,
April 16-30, 1990

CARBON FIBRE PLASTIC

A novel material developed in the Soviet Union could represent a breakthrough in chemical engineering. The material made up of carbon fibre plastic is said to be corrosion-resistant, strong and heat-resistant. It can be used for making various parts of chemical equipment: sliding-contact bearings, sealing rings, flow duct parts and parts of end seals of impeller pumps, and other components for operation in aggressive media at 150 degrees celsius. Carbon fibre plastic is a composition based on carbon filler and a synthetic binder with mineral additives. The fibre plastic moulding composition is highly fluid so that press moulding may be used for obtaining large-size intricately shaped parts without further machining. The new material has a structure which ensures stability of properties of the material, its high operating performance, abrasive resistance and tightness.

While the carbon fibre plastic exhibits good chemical resistance to acid aggressive media, impeller pumps with the flow duct made of the material are widely used in the chemical industry for pumping aggressive acid fluids in the manufacture of man-made fibres, mineral fertilisers and in the manufacture of metalware. In addition to high impact strength, the material exhibits good anti-friction properties.

-- P.T.I. Science Service,
April 16-30, 1990

NEW METHOD FOR DISINFECTING WATER

Rehovot — a novel method of disinfecting water, based on solar energy, is being developed in Israel. The research aims at synthesising new dyes to be used in a photochemical method of disinfection of effluents, based on sunlight. In the photochemical method, the water to be disinfected is exposed to sunlight and treated with a small amount (less than one part per million) of a dye, methylene blue. The dye absorbs the light energy, transferring it to the oxygen dissolved in the water. The resulting high energy oxygen is a powerful oxidant, killing microorganisms in the water without forming dangerous by-products. After less than one hour of exposure to sunlight, bacteria such as coliforms, fecal coli, or enterococci are reduced by a factor higher than 1,000 and polio viruses (which are ordinarily resistant to chlorine) by a factor higher than 100. After this treatment, effluents have a low microbial count and can be used to irrigate edible crops.

Effluents are sometimes used for irrigating industrial crops, such as cotton, but cannot be used for edible crops. Ordinarily, most of this water is dumped into the ocean, usually undergoing chlorination, which kills many of the disease-causing microorganisms but produces toxic substances which are hazardous to the environment.

After undergoing successful tests at a sewage treatment center in Israel, the photodynamic process is about to be applied on an even larger scale at a pilot plant being built in the Tel Aviv region. The process could eventually be used instead of chlorine to disinfect effluents, drinking water, swimming pools, and certain kinds of industrial wastewater. This project is being developed jointly by the Weizmann Institute of Science and the Volcani Center.

-- News from Israel

IDPL DEVELOPS ANTI-ARTHRITIC DRUG

Researchers at the Indian Drugs and Pharmaceuticals Limited (IDPL), Hyderabad have developed a new anti-rheumatoid arthritis drug which, they claim, is an improved version of the existing brands. The drug, IDCIN-ER, is very specific for the treatment of arthritis and has minimum side effects, said IDPL scientists after it was launched formally in April.

One of the novel features of the new drug is its prolonged action which shortens the drug regimen for patients. Unlike the existing drugs which act for six hours, the IDPL drug is potent for 12 hours.

Work on the new drug started at the research and development centre in Hyderabad five years ago. Trials were carried out at three centres at the Jaslok Hospital in Bombay, All India Institute of Medical Sciences (AIIMS), New Delhi, and the Post Graduate Institute (PGI), Chandigarh.

Clinical trials have demonstrated the superior action of the drug and its manageable side effects, according to IDPL scientists. The institute plans to market the drug shortly. Rheumatoid arthritis is one of the serious forms of nearly 100 types of arthritis identified.

-- P.T.I. Science Service,
May 1-15, 1990

NEW SOFTWARE FOR DESIGNING COMMERCIAL PLANTS

New software programmes which may prove useful in designing commercial plants have been developed by the Computer-aided Design (CAD) Centre of the Indian Institute of Chemical Technology, Hyderabad.

Four of these new software programmes pertain to pressure vessels —metal containers capable of withstanding bursting pressures. They are usually cylindrical or spheroidal in shape. A new 'rnf' programme has been developed for the design of reinforcement of openings in pressure vessels. It can design for 15 types of nozzle attachments.

The 'extpr' programme, for the design of pressure vessels subjected to external pressure, can design for 15 different ferrous materials. Similarly the 'intpr' programme designs pressure vessels subjected to internal pressure and also calculates the weight of the vessel when it is empty and filled with water. It can design vessels for 16 different ferrous construction materials.

The 'bsfrp' programme designs pressure vessels made of fibre reinforced plastics subjected to internal pressure. Besides these, there are two programmes for tubesheets and pipeline designing. The 'fxts' designs fixed tube sheets for a shell and tube exchanger while the 'prodrop' calculates the pressure drop in pipelines with single phase flow.

-- P.T.I. Science Service,
May 1-15, 1990

SCIENCE-INDUSTRY CONSORTIUM IN BIOTECHNOLOGY LAUNCHED

A Science-Industry consortium has been launched with a view to developing products, processes and services in the field of biotechnology. The objective of the consortium is to catalyse the interaction between the industry and research institutes including universities so as to convert through such interactions the concepts and ideas into goods and services for the marketplace through the industry.

The objectives also include short and long-term institutional research with one to one tie-ups with the industries, leasing and renting of R & D facilities, development of entrepreneurs, taking up specific projects on jobbing basis, initiating product development, and furthering process improvement in the field of biotechnology, with the ultimate intention of becoming economically self-supporting at lease in certain areas within a reasonable timeframe.

The proposal now envisaged is to bring under one umbrella all the key components including the research institutes, the industry, the financial sources and the government departments together to foster the conceptualisation of products and processes faster with a view to developing saleable biotech products by the industry using the already established infrastructure and the indigenous research capabilities.

The consortium is envisaged in three phases. Phase-I concerns the products and problem identification followed by the preparation of an initial prefeasibility report. In phase-2, the pilot scale development of prototypes, validation, market surveys and the preparation of techno-feasibility report will be considered while in Phase-3, the manufacturing activities and the marketing of products are expected to take place.

-- P.T.I. Science Service,
May 1-15, 1990

SYNTHETIC MUSK

Indian scientists have synthesised an organic compound called Astrolide which has the long lasting odour of musk. Natural musk is perhaps the most prized perfumery ingredient of animal origin. It is the dried up glandular secretion of the musk deer that lives mainly in the central Asian highlands. To obtain the prized musk pod, the musk deer is lured to its death — in a variety of ways. Naturalists estimate that 60,000 to 100,000 musk deers are killed each year for their pods of musk. The rest of the animal's body is just thrown away, since no economical or practical way of utilising its meat or skin has yet been perfected.

But fortunately musk is used in perfumes in a very small quantity. As of today, the sale of musk being mostly clandestine, it fetches between 200,000 and 250,000 rupees per kilogram. There are now a few musk deer farms, where the pods are surgically removed without destroying this almost extinct species of animals.

Natural musk contains a ketone called muscone. Several synthetic organic substitutes have been formulated in the past, but they belonged to families which were totally unrelated to muscone. Although they exhibited the characteristic odour of musk, yet it does not linger for a long time, which is one of the perquisites of perfumery industry.

The new product, an organic compound, has a clean, long lasting and powerful odour of musk and also has an excellent fragrance. It is a colourless, moderately viscous liquid, slightly heavier than water and soluble in ethyl alcohol and other conventional organic solvents.

It can be used in perfumery preparations, toiletries and cosmetics like soaps, shampoos, bath preparations as well as incense sticks, and even as a room air freshner. The use of astrolide will eliminate the need to hunt for musk deers and kill them to take out the musk pod, saving the animal from extinction.

-- P.T.I. Science Service,
May 1-15, 1990

NEW INSIGHTS ON GROWTH HORMONES AND PLANT DEVELOPMENT

A unique parasitic plant called Cuscuta, which has no leaves or roots, is giving scientists valuable insights into the effect of growth hormones on plant development. The flowering parasitic plant twines around other green plants, and penetrates its host through special organs called haustoria which grow into the host's food channels and absorb nutrients and water.

Scientists at the Indian Institute of Science (IISc), Bangalore, believe the simple structure of Cuscuta makes it a convenient experimental material to study how hormones influence the various stages of plant life. The linear cylindrical vine comprises a series of cells representing a developmental sequence in time. Successive stages of cellular growth and differentiation can be studied through this vine.

Scientists at IISc's department of biochemistry tested the effects of five classes of plant growth substances —auxins, cytokinins, gibberellins, abscisic acid and ethylene — Cuscuta vines from the apex downwards.

They found that gibberellin was

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required for continued growth while cytokinin promoted coiling growth in the stem segment. In the absence of cytokinin, the plant growth is straight instead of coiling, the coiling growth induced by cytokinin can be reversed by auxins in high concentrations.

The shoot tip, which goes into the new branches of the same host and to new hosts, responds to gibberelic acid for its growth. Experiments showed that in its absence, the male shoot tip stops growing. Any imbalance in the growth hormones lead to a lopsided growth.

The study also found that the region for elongated growth extends upto 15 cms from the apex. Segments beyond 4 cms are not capable of tight coiling as sufficient amount of auxin does not reach the extended segment. Haustoria are again dependent on the hormones: cytokinin develops and strengthens them while excess auxin weakens them.

The IISc team, led by Dr. S. Mahadevan, says Cuscuta has evolved from normal green plants with green leaves and roots. They are now investigating the possible genetic alterations that led to the loss of leaves and roots and growth of the Haustoria.

-- P.T.I. Science Service,
May 1-15, 1990

SUBSTITUTE OF BROMINATED VEGETABLE OIL

Researchers in Delhi claim they have found a non-toxic substitute for brominated vegetable oil (BVO) which has become the focus of public interest in recent times because of the government's ban on the use of BVO. Brominated vegetable oil is used as an important ingredient by soft drink manufacturers to produce a clouding effect in their products.

However it became the centre of a controversy when researchers found that it could cause cancer, and the Government of India banned its use with effect from April 15 this year.

The Shriram Institute of Industrial Research (SRI), New Delhi, now reports that its scientists have successfully develped a non-toxic substitute for BVO using chemicals that have been approved by the Prevention of Food Adulteration Act (PFA).

The new formulation is based totally on indigenously available chemicals and has given "highly satisfactory" results during trials, SRI scientists claim.

It imparts a good stability to the soft drinks, without having any side effects. It has also been found to be superior to other known substitutes of BVO like ester gum.

-- P.T.I. Science Service,
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New Products

GLASS MICROFIBRE FILTERS PROVIDE HIGH PARTICLE RETENTION WITH FAST FLOW RATES AND HIGH LOADING CAPACITY

A recently introduced laboratory glass microfibre filter known as Multigrade GMF 150, consisting of two layers of glass microfibres, one coarse and one fine (Fig. 1), offers higher particulate loading capacities and much faster flow rates than conventional prefilters of uniform density.

Multigrade GMF 150 is the latest in a range of glass microfibre filters supplied by Whatman Scientific Ltd., of Maidstone, England. The GMF 150 filter is available in 1 µ and 2 µ grades and in diameters of 25, 47 and 90 mm. The total thickness of the two-layer filters is 730 µ and 750 µ respectively.

Due to its high loading capacity and fast flow rates the GMF 150 is ideal for the filtration of large volumes and of solutions that are traditionally difficult to filter, especialy those containing wide variations in particulate size. When used in conjunction with a membrane, the filter greatly improves the life and flow rates of the membrane by reducing the blinding of the surface pores.

Temperatures up to 500°C

Like all Whatman glass microfibre filters, Multigrade GMF 150 is made from 100% borosilicate glass, is compltely free of chemical binders and can be safely used at temperatures up to 500°C. They can also be used at very low temperatures without embrittlement or significant changes in performance.

It is essential that all glass microfibre filters be used flat, to avoid damage to the filter structure, which would be caused by folding. Consequently, all such filters should be used in a filter holder in which the filter remains flat and is supported over its entire surface.

Other Whatman glass microfibre filters are available for a variety of applications, including the isolation of precipitated proteins and nucleic acids, cell harvesting, liquid clarification and for water and air pollution analysis. Of the seven grades in the glass microfibre range the finest grade is GF/F, which will remove particles as small as 0.7 µ from liquids. Compared with other types of filter of similar porosity, Whatman glass microfibre filters exhibit

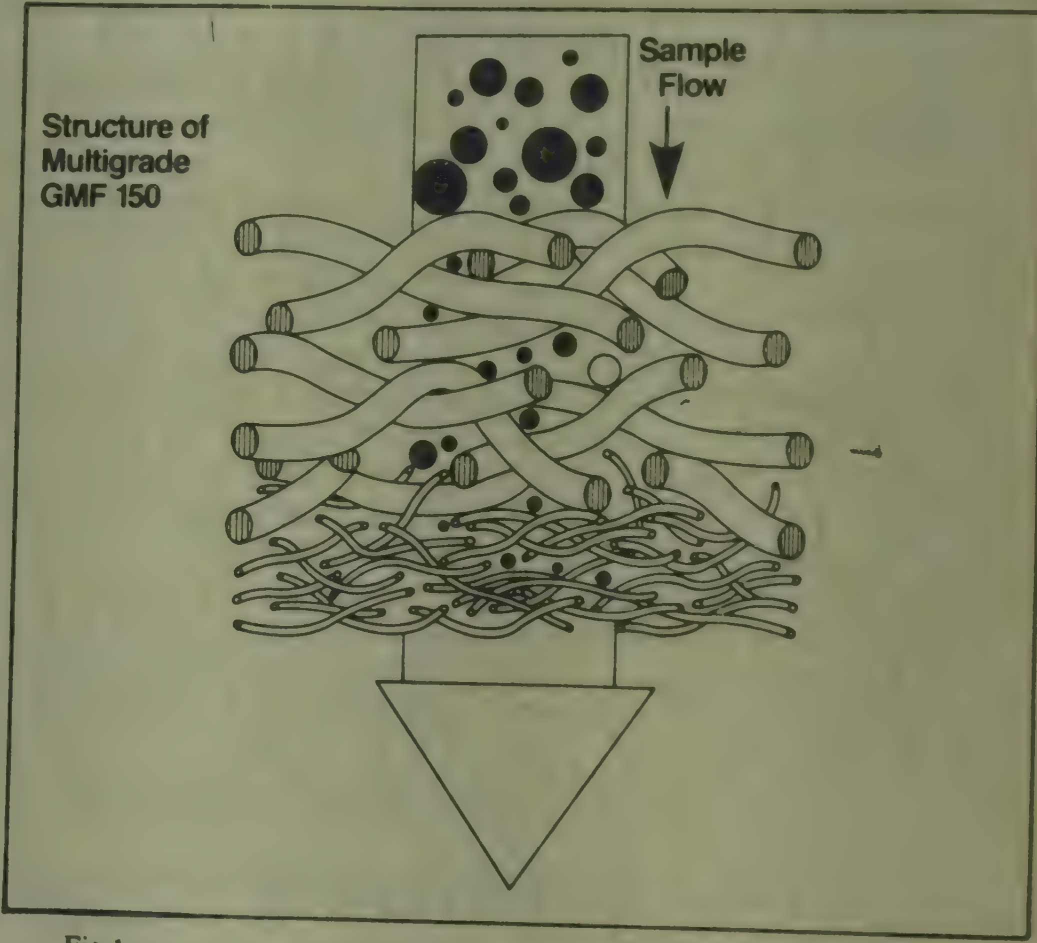
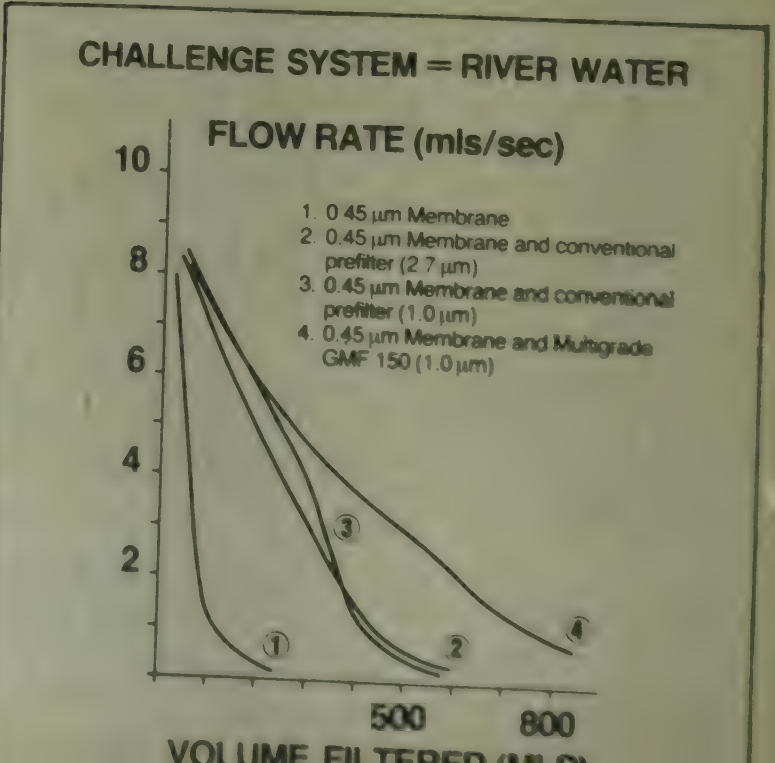


Fig 1

NS 3350



very high flow rates and excellent loading capacity. In some cases the use of a GF/F prefilter can significantly extend the life of a membrane filter.

Enhanced performance

The structure of Whatman glass microfibre filters provides a combination of excellent retention characteristics, high loading capacity and fast flow rates. These are all important considerations when selecting a filter for a particular application. The ideal situation is one where all the required particles are removed from the sample at the optimum filtration speed.

The high flow rates of glass microfibre filters provide the opportunity for significant time saving, compared with more traditional filters of similar retention. This can be particularly important in today's busy laboratory schedules. Whatman glass microfibre filters are available in a range of standard sizes from 1cm to 29.3cm, with other sizes to special order.

High-volume air sampling

EPM 2000 is a high purity glass microfibre filter developed for use in high-volume air sampling equipment and for the detailed analysis of particulates, has a retention efficiency of 99.999% for sub-micron particles down to 0.6 μ. It has a lower resistance to air flow, finer particle retention and a higher loading capacity than conventional cellulose filter papers. EPM 2000 filters, measuring 8 in x 10 in (20.3 x 25.4 cm) are supplied in packs of 100, each sheet being individually numbered to ensure correct identification during use.

In view of the critical applications of EPM 2000, the raw materials are pretreated to reduce trace elements to a minimum. EPM 2000 filters are also heat-treated to remove any traces of organic material. For monitoring radio active vapour and particulates, Whatman produces a filter made from cellulose and glass microfibres, known as Grade 72, which is loaded with activated carbon.

Further information from: Whatman Scientific Ltd., Springfield Mill, Maidstone, Kent, England, ME14 2LE. Tel.: 0622 692022; (Int.) +44 622 692022. Telex: 96113. Fax: 0622 691425; (Int.) +44 622 691425.

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Other specifications may include photo mask protection, silicone wafer dicing, film splicing. These tapes have been approved and accepted by electronic/electrical industries.

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Is PID Dead? — an Exploration of Two Alternatives*

PETER HORSFIELD**

INTRODUCTION

When writing the synopsis it was intended to give the same degree of attention to the two technologies in question --namely Expert Systems and Predictive Control. In researching the subject matter in the preparation of the paper it has become apparent that much less has been published about predictive controllers than expert systems. In consequence, the paper has been heavily biased in favour of giving more exposure to the less well known predictive control technology. In the available time to present the paper this means the treatment of the expert system technology is then necessarily somewhat superficial. The author apologises to any of the audience who are disappointed by this.

The theme of the paper is to provoke thought by questioning the natural assumption that the conventional three term controller is the only basis for process control. Let us begin by establishing a common understnding of three term or PID control. Then we can look at each alternative technology in turn, before returning to consider the threat, if any, they each pose to PID.

What is PID then?

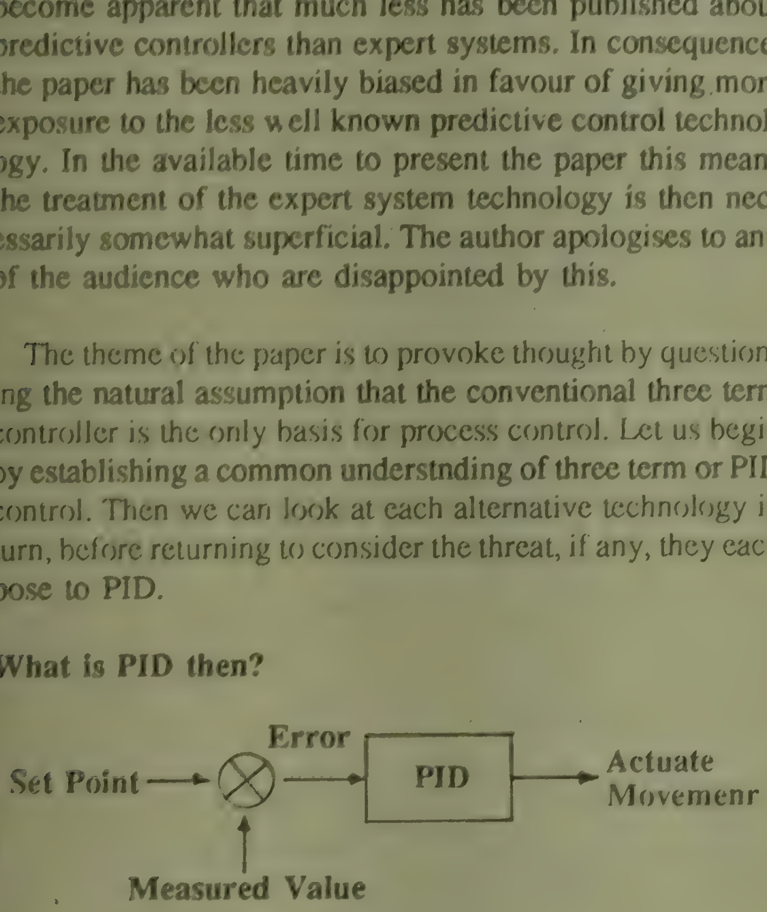

Fig. 1.1

The above may be expressed mathematically:

$$\text{Actuator Movement} = \text{Gain}\left(\text{Error} + \int \frac{\text{Error}}{\text{Ti}}\,dt + \frac{d}{dt}\,\text{Error Td}\right)$$

In our three term controller, the terms are:-

Proportional = Gain x Error

$$\text{Integral} = \text{Gain} \times \int \frac{\text{Error}}{\text{Ti}}\,dt$$

$$\text{Differential} = \text{Gain} \times \frac{d}{dt}\,\text{Error}\ \ \text{Td}$$

EXPERT SYSTEMS

The discussion of this technology will be organised as follows:

- -- concepts and terminology
- -- available products
- -- summary of benefits

Remembering the introductory remarks, the treatment will be superficial. For those of you with a deeper interest and disappointed with this approach, you may be interested in obtaining copies of an internal report being prepared by John Brown.

Having said this, led us look at some terms and concepts as a view of the technology.

Expert System Technology

Let us define that our interest is only in Expert System to be applied to the realtime control/monitoring of processes and/or plant.

With this definition we can consider the basics of any Expert System as being:

- — Knowledge base
- — Inference engine

But like all "process control" systems we also need:

—Plant/process database

— Man-machine interface

Lets look at each of these and indroduce some common terms and concepts.

Knowledge Base

An expert system product with an empty knowledge base would commonly be termed a "shell". "Toolkits" can be used to build shells.

An application level expert system product would be supplied with a knowledge base approximating to the knowledge of a well educated graduate engineer. In other words it knows

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* Presented at Oil, Gas & Petrochemical Seminar 1989

** Address: John Brown Engineers & Constructors Ltd., 1, Buckingham Street, Portsmouth, Hants, PO1 1HN. United Kingdom.

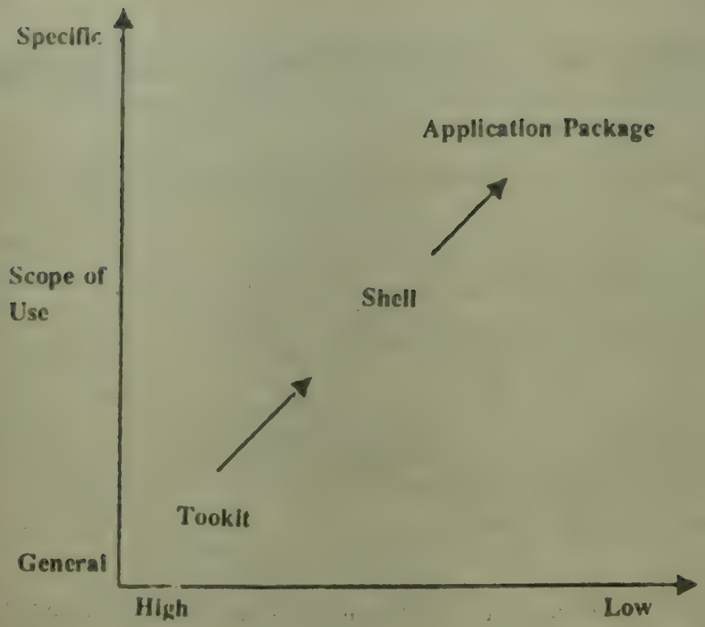


Fig. 2: Programming Skill Required

for example about the general properties of and interactions between plant vessels and instrumentation. But does not know about your specific plant configuration, nor your specific process and operating practices. It is necessary to have a "knowledge engineer" elicit this knowledge from one, or more likely several, of your engineers and managers and build it into the knowledge base. Your people in this context may be referred to as "domain experts". The term "knowledge engineer" generally is taken to apply to the role an engineer is performing rather than indicating a particular specialisation. Some vendors may disagree with this approach. In building your knowledge base you will have may rules derived from solid technical facts. You will also have some "heuristic" rules based on commonly accepted working pratice, known to give good results, but without technical justification.

The knowledge base may be made up of "rules" and/or "objects" or "frames". Rules usually take the form of "If ..... then ....".

"If the gas flowrate is high then the vessel pressure will rise."

Objects are often but not exclusive representations of plant equipment and instrumentation. They may be organised hierarchically in "inheritance lattices" where common attributes are inherited downwards as the definition of the objects become more and more specific. "Causal couplings" may be established between objects as a means of defining some relationship between say plant equipment items.

Inference Engine

The "inference engine" is the magic part of an expert system. How it does what it does is esoteric computer science. What it does is of interest to us. In response to events the inference engine dips into the knowledge base and applies rules/objects to the event and creates hypotheses and/or conclusions. Many different hypotheses may be valid at any time depending on the completeness of the description of the event/circumstance. These hypotheses would be organised in an "hypothesis network" or "inferencing network". In this way an expert system is able to explain why it reached a particular conclusion from a given set of events or circumstances. An important aspect of an expert system is its ability to handle uncertainty. In this respect "fuzzy logic" may be relevant. With this feature an expert system would accompany a conclusion with an evaluation of the probability of its correctness.

The inference engine may use "forward chaining" and/or "backward chaining" in creating the hypothesis network. Given a set of input conditions forward chaining follows logic paths to reach conclusions and would be used in such applications as process monitoring/control. Backwards chaining postulates hypothesis and works backwards through the logic in order to confirm or deny the hypothesis, and would be used in such applications as fault finding.

Vital for our realtime applications, is that time should be taken into account in these hypothesis networks. Just because a hypothesis was true at one instant of time it cannot be assumed to remain true for all time. As time passes the hypothesis network must be reviewed. It must be a "dynamic hypothesis network".

Plant/Process Database

The expert system needs data from the plant/process and perhaps access to the plant/process for supervisory control. Sensibly, this would be via an existing well established conventional control system.

Man-Machine Interface

This will normally be a high resolution graphics terminal and may or may not be colour terminal. It is important that the nature of the man-machine interface should not turn operators into slaves. The operators should be able to ask the expert system to justify its decisions, and be able to reject them as necessary.

This concludes an admittedly brief review of the technology. Now let us look at some products in the UK market.

Expert System Products

First let us differentiate between knowledge based systems and true expert systems. A knowledge based system will have encoded in its knowledge base fixed conditions for the "firing up" of its rules. These products have their place in the market but are not true expert systems in that they lack an inference engine.

There are many shells and even more toolkits. In the interest of brevity only the application level products will be considered.

There are three obvious examples of majar application level products available in the UK:

ESCORT
COGSYS
G2

ESCORT is available from PA Computers and Telcommunications. It is being developed by PA in conjuntion with British Petroleum. Its first installation is planned shortly on a Butadiene Plant.

Of those systems seen by the author this has the best developed man-machine interface, and the widest range of fuctionality. Currently the costs for an ESCORT system are appoximately £50,000-£800,000 for hardware and software. However, it is understood the software licence fee is likely to be reduced soon.

COGSYS is being developed by Systems Designers PLC on behalf of a club of users and vendors. Pilot installations are understood to be underway at this time or in the very near future. In the near future this product will no doubt make a significant impact on the market. No figures for selling prices were available to the author at the time of writing this paper.

G2 is a US originated product being marketed in the UK by SIRA. It has the advantage that significant numbers of installations in the US are claimed on its behalf. Its man-machine interface and general capability seem to the author to be somewhat inferior to ESCORT, but it appears to be field proven and costs approximately 50,000-95,000 for hardware and software.

Summary of Benefits

In its applied form, it is a customised computer driven knowledge acquisition and information processing system which, to some extent, emulates human behaviour. As limited by current technology, it can be capable of:

—storing and manipulating knowledge in a symbolic form
—deducing conclusions from an implanted set of rules and observed events
—inductive reasoning to postulate causes for observed effects
—explaining the path of its logic with reasons

Benefits can arise in strategic and operational areas, as follows:

—protection of technological "know how"
—minimising "individual" knowledge
—capitalising knowledge
—crisis avoidance and upset handling
—equipment problem warnings
—process interaction explanations
—past event analysis

Some vendors are claiming studies have shown quantifiable savings measured in hundreds of thousands of pounds sterling per annum-in more than one of the above!

PREDICITIVE CONTROL

Let us begin by looking at an overview of the basis of this technolgy. A rigorous mathematical treatment has been presented elsewhere by others. It is beyond the author's ability to reproduce this here.

The relevance of the technology can be better appreciated by engineers by examination of a specific case study. Following one such study in some detail, some other case studies are very briefly outlined. Finally, there are some comments on products availability.

Overview of Technology

The basis of the technology is to derive an approximate model of plant dynamics from practical measurements where the model is sufficiently accurate to allow a control system to be designed from it. Thus the two basic elements of the technology are:
— Modelling
— Control System Design

Let us look at each in turn.

Modelling

The mathematical basis of this technology takes the standard state-space and measurement equations for linear and timeinvariant multivariable systems, enhanced to incorporate continously varying disturbances and pure time delays, and aims to produce a discrete time-domain equation with the following properties:

i. Only measurable outputs, control inputs and measurable disturbances, are involved in the process description.

ii. The equation structure is similar to that of the standard discrete state-space equation, so that the state-space, time-domain, control-system design method are applicable.
iii. The structure is suitable for the direct application of statistical modelling.
iv. Maximum flexibility is offered for selection of discrete intervals for measurement sampling and control.
v. Precise knowledge of process time delays is not required.

Satisfaction of these properties leads to a structure well suited for the approximation of the dynamic of industrial plant and for subsequent control-system design.

To create a model suitable for the design of computer-control systems, a discrete interval is defined. The controls are constrained to be constant across this interval. The disturbances are approximated as ramp functions with constant gradients across the discrete interval. Fig 3 illustrates the control and disturbance signal characteristics. The ramp approximations are acceptable if the disturbances vary slowly relative to the interval t. Piecewise ramp approximations of the continuously varying signals permit a more accurate process representation than piecewise steps.

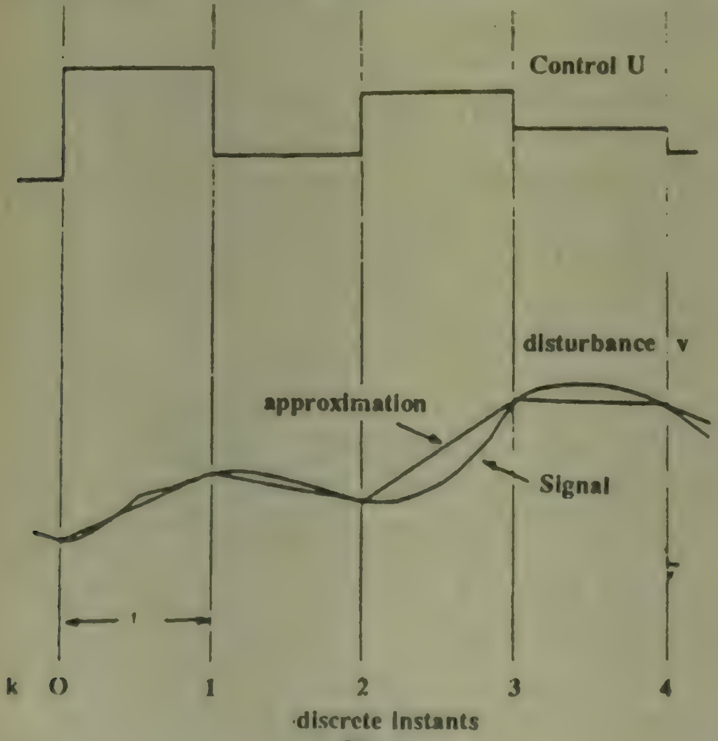


Fig. 3

A criterion for measurement and control sampling is now defined. A discrete control system operates by computing control corrections at specific instances in time. Measurement samples for control calculations are normally taken only at the instants of control corrections. This can place an unnecessary restriction on model structure. Here, a more generalised scheme of measurement is defined to give maximum flexibility in the choice of a sampling pattern. Each control interval is divided into a number of sampling intervals. The sampling intervals, referenced backwards from the control instant, define the instants at which measurement samples are collected. The sampling pattern is identical across each control interval.

The object of the mathematical analysis using recursive least squares techniques is to establish a process model that is compatible with the control and sampling structure. The model is to predict all samples across the future control interval, utilising measurements from the current and preceding control intervals.

Control System Design

The model derived above is restructured to make its expression suitable for the application of discrete dynamic programming. A "cost" function is derived related to Set Point/Measured Value Errors and Actuator Movement. This cost function is minimised to give a control algorithm.

This control algorithm is extended to account for disturbances and time delays. The final control equation caters for multivariable interactions, time delays and feed forward compensation of disturbances. It has these properties:

-- computes corrections in inputs, not absolute values

-- based on difference terms not absolute values

-- outputs only differenced with respect to set up points, not with respect to each other.

This gives us integral action with feedback — just like PID!. In addition:

-- tolerant to non-linearity and time variance in the process

-- no steady state performance offset

-- noise impact not aggravated by successive differencing as conventional differential control action.

The Technology in more detail

Let's look at an implementation of the technology as a means of examining it in more detail, and seeing it in action.

The example application concerns the problems of controlling a multiple effect evaporation in a milk processing plant. The author is constrained to using this example by the need to maintain confidentiality and the limited number of applications of this novel advanced engineering technology. Let me present:

-- an introductory description of the plant

-- the control problem to be addressed

-- the solution of the problem

Plant Description

The evaporator is a pilot plant that is comprised of three main evaporation effects. The plant has about one tenth the throughput capacity of a standard commerical unit. It is designed to concentrate skimmed milk from 9% total solids to around 50%. With reference to Fig. 4, the following main phases make up the plant:

(i) Milk pre-heat. Cold Milk, pumped from storage vats, is initially warmed as it passes through pipes that spiral around the main evaporator effects. Steam is then injected directly into the milk to bring the initial temperature to a desired steady level.

(ii) First effect. Steam is fed to a steam chest that surrounds the first evaporation stage. This steam is generated from a boiler supply. The preheated milk is pumped to the top of the first effect. Evaporation occurs as the milk flows down multiple internal tubes, vapour and concentrate separate at the base of the effect.

(iii) Second effect. The concentrated milk from the first effect is pumped to the top of the second. The steam supplied to the second effect is that evaporated from the milk in the first. The evaporation cycle repeats.

(iv) Third effect. The third effect cascades onto the second in a similar fashion. The concentrated milk may be recycled up to three times through this effect to produce the final product.

(v) Barometric condenser. a two-stage barometric condenser condenses the steam evaporated from the third effect, and thereby maintains a pressure differential across the plant.

Control Problem

Fig. 5 illustrates the plant signals of interest:

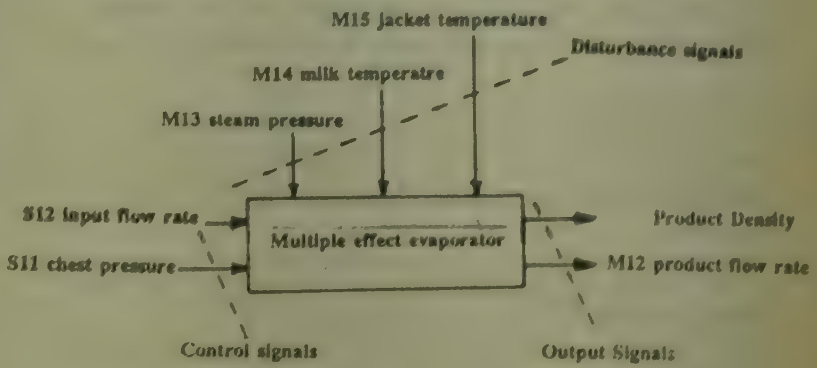
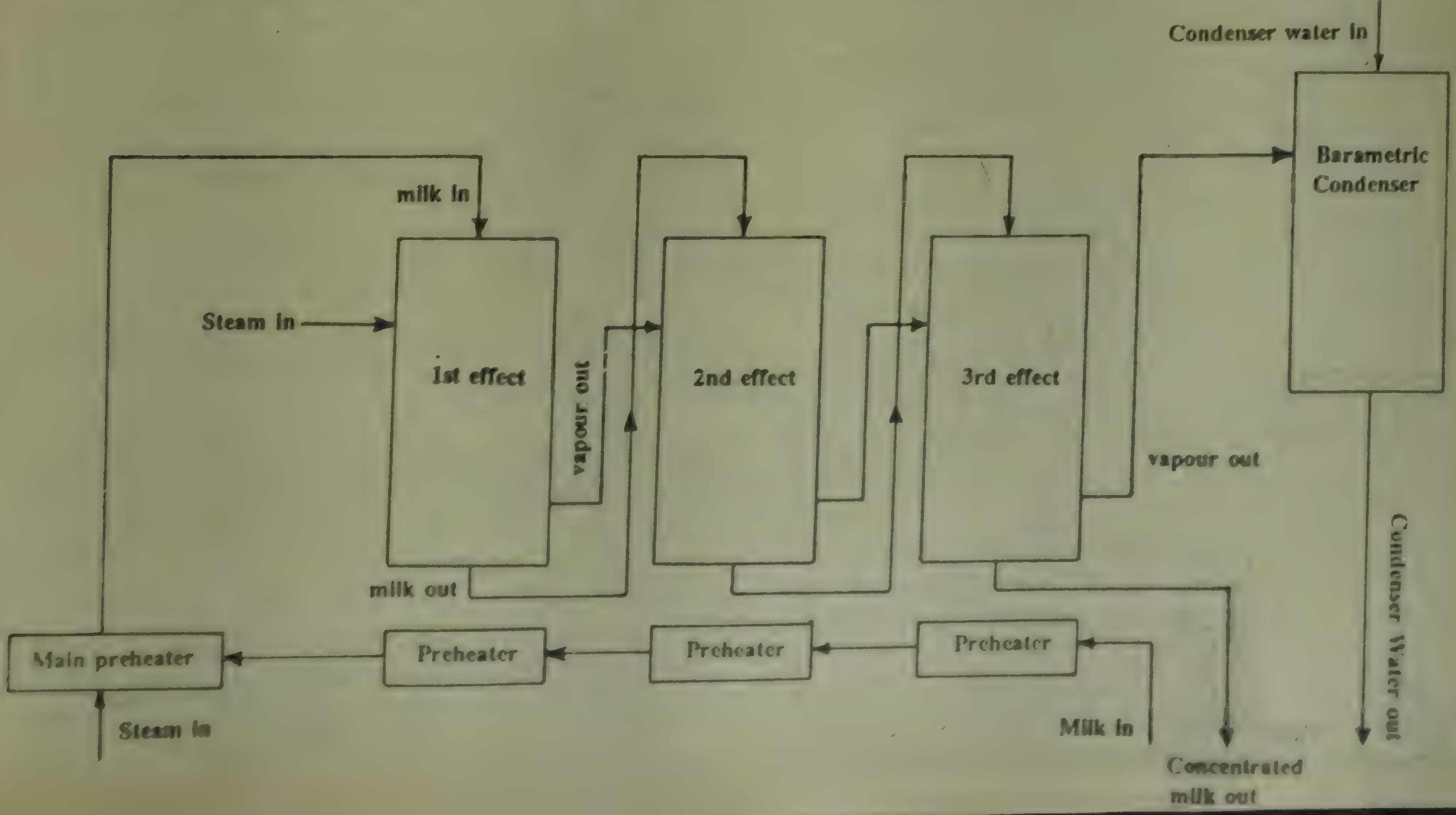

M15 jacket temperature
Disturbance signals
M14 milk temperatre
M13 steam pressure
S12 input flow rate
S11 chest pressure
Multiple effect evaporator
Product Density
M12 product flow rate
Control signals
Output Signals

Fig. 5

These divide into three categories: control signals, output signals, and measured disturbance signals.

The control signals are free to be manipulated as the actuations of controllers. In Fig. 5, these signals are S11, the setpoint to a controller that regulates the pressure in a steam chest that surrounds the first evaporation stage, and S12, the setpoint to a controller that regulates the rate of input flow of skimmed milk to this first stage. S11 in effect regulates the supply of steam, and hence energy, to the plant. The output signals are to be held at defined setpoint values. These signals are M12, the measured rate of flow of the concentrated product from the final evaporation stage, and M11, the mea-


Condenser water in
Barametric Condenser
milk in
Steam in
1st effect
vapour out
2nd effect
3rd effect
vapour out
milk out
Main preheater
Preheater
Preheater
Preheater
Steam in
Milk in
Concentrated milk out
Condenser Water out

sured density of this product. The disturbance signals influence the product but cannot be freely manipulated. Some form of feedforward control correction is necessary to minimise the impact of the disturbances upon the output signals. These signals are M13, the measured pressure of the steam in the supply main, M14, the measured temperature of the supplied skimmed milk, and M15, the measured temperature at the wall of a jacket surrounding the first evaporation stage.

The Solution

We shall solve our control problem by following these steps:

-- Data Acquisition
-- Identification Analysis
-- Control System Design

Let me comment on each of these.

Data Acquisition

This is not strictly part of the technology but there are strong requirements laid on the data acquisition for the technology to be most useful.

In theory we could acquire data from every conceivable plant signal. For practicality engineering intelligence is applied to select a subset of all the possible signals. But, still keep the subset wide! To ensure "richness" of data a Pseudo Random Binary Sequence (PRBS) may be placed on input signals. This is not mandatory if sufficient variability in data occurs naturally. But it is very powerful in the subsequent statistical analysis if it can be accommodated. The amplitude of the perturbations can be small enough to have little or no effect on the plant.

During data acquisition tools to monitor "richness" of data are useful eg power spectrum analysis, and realtime cross corelations. The following data was collected and will be the basis of the subsequent discussion.

Fig. 6 illustrates the data which spans 82 minutes with a 6 second interval between sampled points. The signals S11 and S12 were perturbed with random amplitude with adjustments occurring every 2 minutes. The mean levels of the perturbations were chosen so that the output signals M11 and M12 varied around the normal operating levels of the plant. In fact, adjustment of these mean levels had to be made during the course of the data acquisition to prevent the output signals straying too far.

It was not known at the time of the data acquisition if the signals M13, M14, and M15 were significant as disturbances. They were monitored because disturbing influences were considered likely. The variations in M13, the steam supply pressure, occurred because of other users drawing steam. The milk temperature M14 varied because it was necessary to switch supply vats during the course of the data acquisition. The upward drift in the temperature M15 occurred because the plant slowly warmed up as operations progressed.

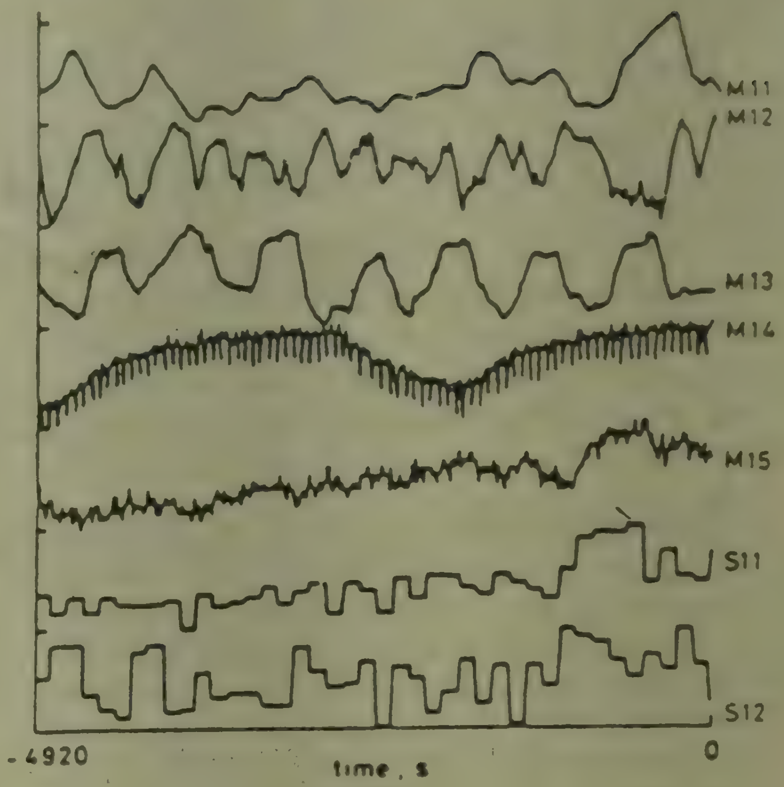


Fig. 6

Plant date
M11 milk density, 1164 to 1205 kg/m^3
M12 output flow rate. 93.52 to 243.3 l/h
M13 steam pressure, 7.788 to 8.282 bar
M14 milk input temperature, 17.08 to 25.27°C
M15 jacket temperature. 64.39 to 67.56°C
S11 chest pressurem, 315 to 339.2 mbar
S12 milk inflow rate, 1620 to 1700 l/h
Each signal is confined to a partition within the notches on the y-axis. This indicated scales correspond to the lower and upper notches of the relevant partition.

Identification Analysis

The objective is to derive a model meeting the following practical requirements:

(a) Only accessible plant signals can be considered, otherwise significant prior knowledge of plant characteristics is necessary. Thus the model has an input and output structure, with no states.

(b) It must be representative of a broad range of plant situations. The model therefore generalises from the simplest single-input situation to the complex (though linear) situation with many inputs and outputs, and with time delays associated with any or all of the inputs.

(c) It must have a sampled data form so straightforward identification procedures can be used to determine model coefficients. The chosen structure is incremental and involves the difference of both inputs and outputs. This makes identification analysis less sensitive to signals with drift or nonlinearity.

(d) The structure must be minimal with as few coefficients as possible, otherwise resulting control systems can be unwieldy.

(e) It must be amenable for control system design and give rise to realistic control algorithms. A feature of the structure is that it leads to control systems with error feedback and incremental (i.e. integral) action, the two properties that contribute greatly to the robustness of conventional two or three term controllers.

To achieve these requirements two steps are necessary:

(a) The choice of model structure best suited for fitting the plant data at hand. Structure in this context means the signals to be associated with the model, the order of process dynamics, the magnitude of input delays, the sampling and prediction intervals etc.

(b) Analysis to derive the coefficients associated with the chosen structure.

This can be detailed as :

(a) Synchronisation with plant data: Selection of a time span for analysis, with the start of the span set to coincide with a step change in a particular input signal. This latter aspect is necessary if time delay effects are to be properly evaluated.

(b) Selection of the method of analysis, either biased or unbiased least-squares. The unbiased technique is more accurate but is slower in converging.

(c) Definition of signals to be associated with the model, by referencing the analysis to the first of a set of linked control loops.

(d) Selection of the order of process dynamics that the model is to approximate, and also of the control and the sampling intervals.

(e) Selection, for each input signal, of the magnitude of any time delay and of the signal characteristic (step or ramp).

(f) Selection of the number of times the data span is to be scanned by the analysis, before convergence is presumed.

(g) A print of the trace of the covariance matrix associated with the least-squares identification following each scan of the data span, to give a measure of progressing convergence.

(h) A print of the coefficients of the identified matrices.

(i) The generation of residual signals from the identified model. These are obtained by subjecting the model to the same input signal sequences that originally disturbed plant. There are three forms of signal derived: (i) Model outputs, which may be compared directly with the plant measurements, (ii) Absolute residuals, formed as the difference between the model and the plant over the data span, (iii) Incremental residuals, formed as the difference between the amount that the plant changes and the amount that the model changes in each control interval, over the data span.

These residual signals may be graphed against the original data to give a picture of model accuracy.

Two figures of merit are derived for each plant measurement. The first is the mean value of the absolute residual, which gives an indication of drift, occurring in the data, that is not described by the model. The second is the RMS value of the incremental residual, which gives a measure of how closely the shape of the model characteristic compares with that of the plant. Both of these figures are normalised so that values close to 1 indicate poor quality and values close to 0, good quality.

(j) Identified models may be stored on disc file and may be subsequently recalled. This permits models to be compared, as in (i) above, against data not used for derivation of the model. This is an important test to ensure that a derived model is not particular to just one set of data.

(k) Step (i) can be performed with particular input signals suppressed, so that the contribution of individual input signals to the overall model can be assessed.

(l) Model outputs generated from step (i) may be subtracted from the plant data to eliminate the influence of particular inputs. Remodelling, on the processed data, can lead to simpler model structures.

Let's see how this may be applied to our multiple effect evaporator. We shall step through a number of refinements of a model showing how it is improved. By trial and error and engineering judgement, supported by figures of merit from the software, parameters specifying delays, and order of process dynamics were optimised for a simplistic model structure.

A structure for the model is first specified to involve only the required control and measurement signals, with disturbance signals neglected.

Let us now subject our model to the recorded plant data and compare the model's output with the recorded plant performance.

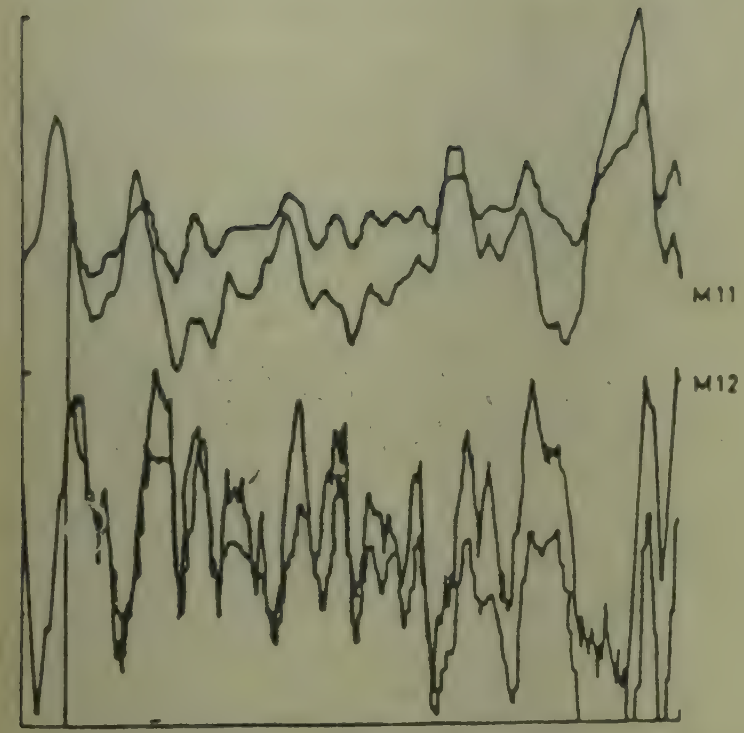


Fig. 7: Comparison between model and plant, best second-order model, no disturbance
M11 milk density, 1164 to 1205 kg/m^3
M12 output flow rate, 93.52 to 243.3 l/h

Further optimisation of parameters (order of dynamics, time delays) gives improvements.

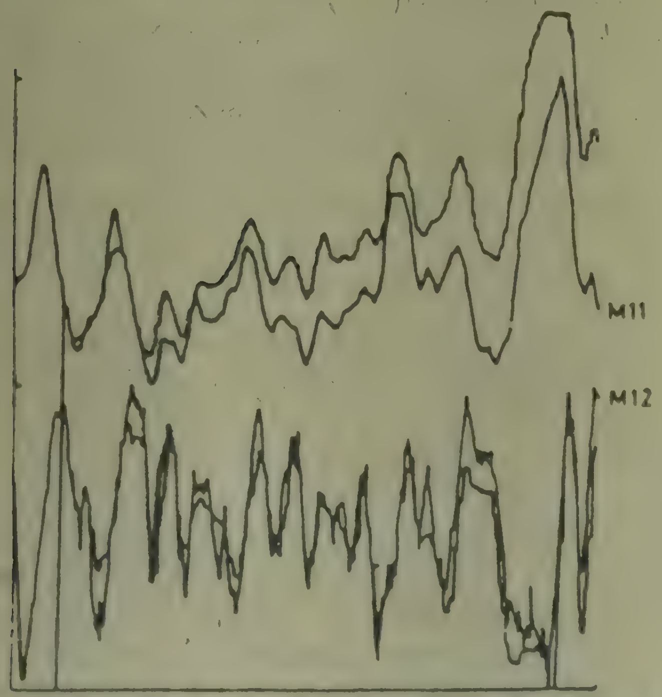


Fig. 8: Comparison between model and plant, best fourth-order model, no disturbance
M11 milk density, 1164 to 1205 kg/m^3
M12 output flow rate, 93.52 to 243.3 l/h

Note the marked drift between model and plant for M11.

Now let us establish what disturbances are affecting the plant. This is done by taking the absolute and incremental residual signals associated with the model and plant outputs and processing these against the available disturbance signals. This establishes M14 as a disturbance signal. Incorporating this in our model produces:

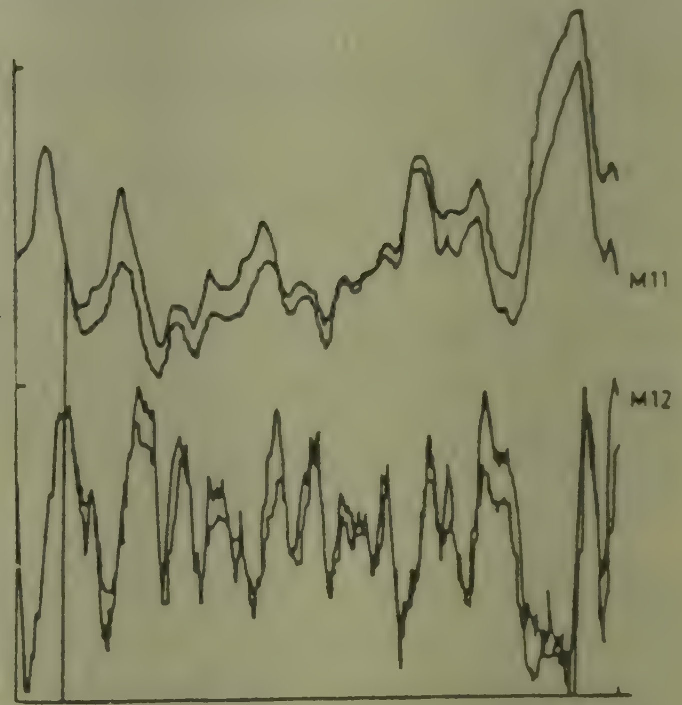


Fig. 9: Comparison between model and plant including M14 as a disturbance signal
M11 milk density, 1164 to 1205 kg/m^3
M12 output flow rate 93.52 to 243.2 l/h

Having established a model let us now turn to the design of a control system.

Control System Design

By minimisation of a "cost" function involving Set Point/Measured Value Error and Incremental Actuator Movement the control system is derived mathematically. Weighting matrices in this cost function define the closed loop response characteristics of the control system. The method to design a control system is :

(a) Select all weightings at unity.

(b) Compute a controller, with the dynamic programming procedure iterating through enough stages to ensure convergence. This leads to a balanced overall response, normally with slight overshoot.

(c) Simulate the performance of the controller, by applying it to the model from which it was derived.

(d) Adjust the weightings to alter the relative rate of response of the measurements and the intensity of control signal corrections. A smaller weighting for one measurement, with respect to another, gives rise to a faster response for the latter with larger input signal deviations. A smaller weighting for one control signal, with respect to another, gives rise to greater magnitudes of deviation for the former. thus a simple joystick manipulation of weighting values, from their normalised settings, can be their normalised settings, can be applied to achieve responses appropriate to the designer's choice.

(e)Repeat steps (b) to (e) until satisfactory responses are obtained.

Using these methods, controllers with and without disturbances compensation were derived to give a minimum time response.

The simulated control system responses are:

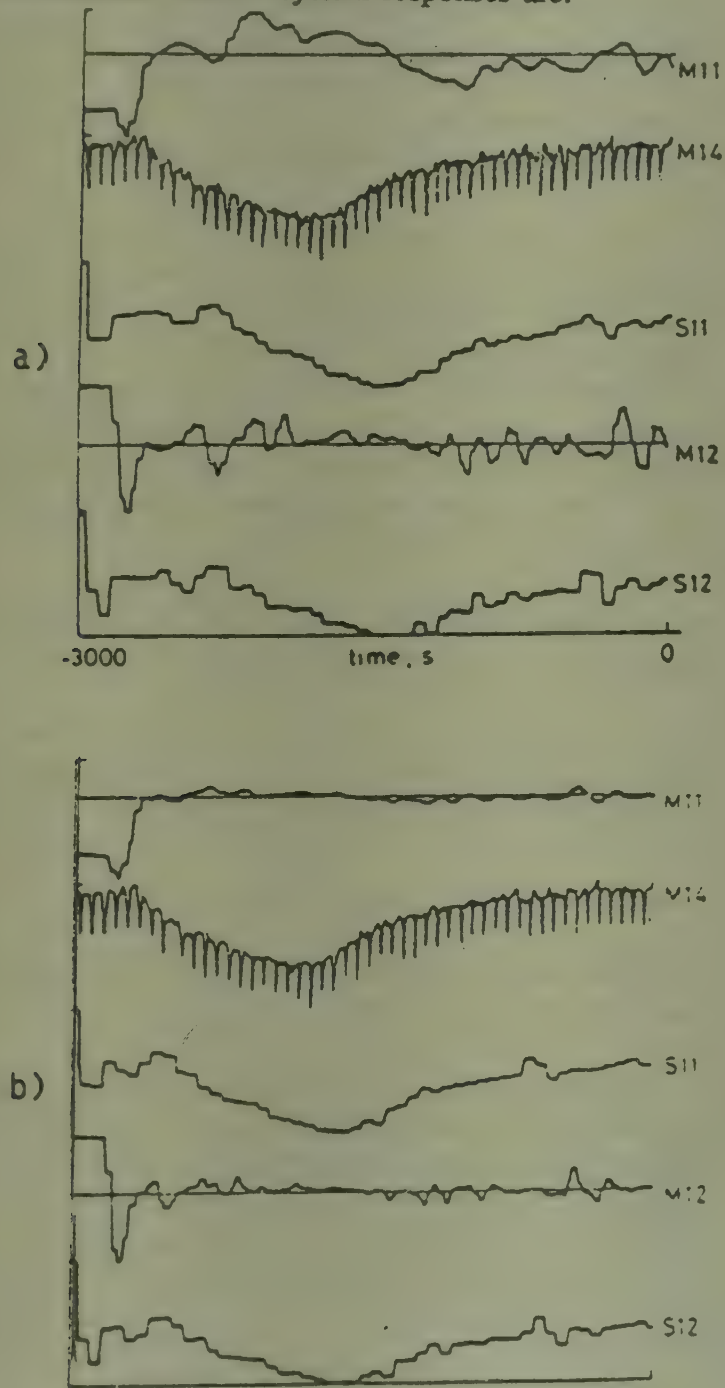
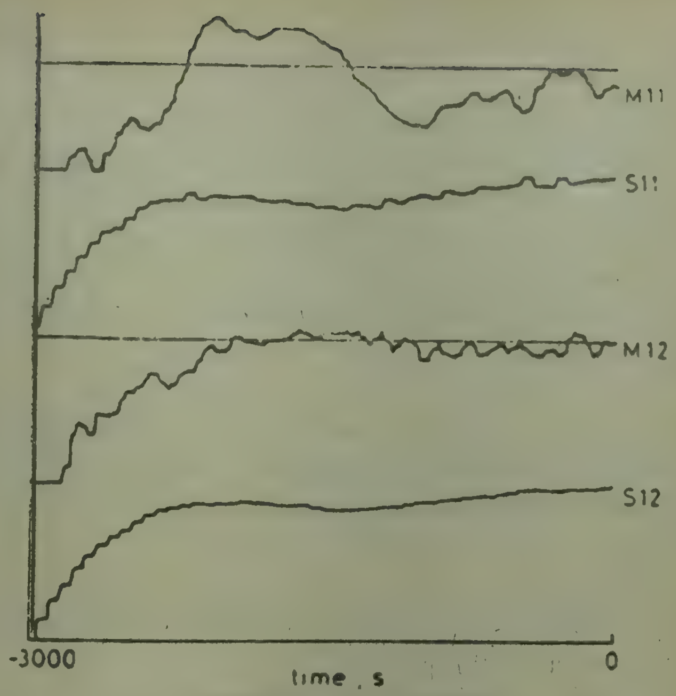
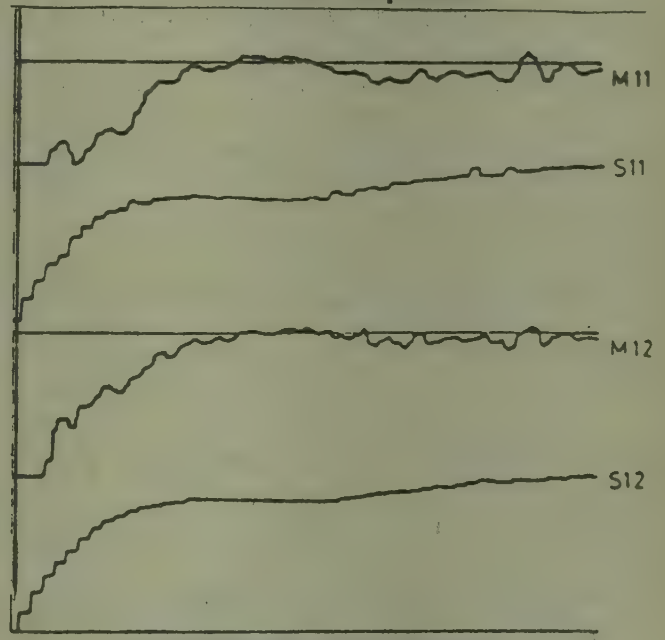


Fig. 10: Minimum time control responses
a no disturbance compensation; b with disturbance compensation
S1, M11 milk density, 1171 to 1184 kg/m³
M14 milk input temperature, 17.57 to 25.27°C
S11 chest pressure, 299.7 to 322.5 mbar
S2, M12 output flow rate, 165 to 229.8 l/h
S12 milk inflow rate, 1448 to 1688 l/h

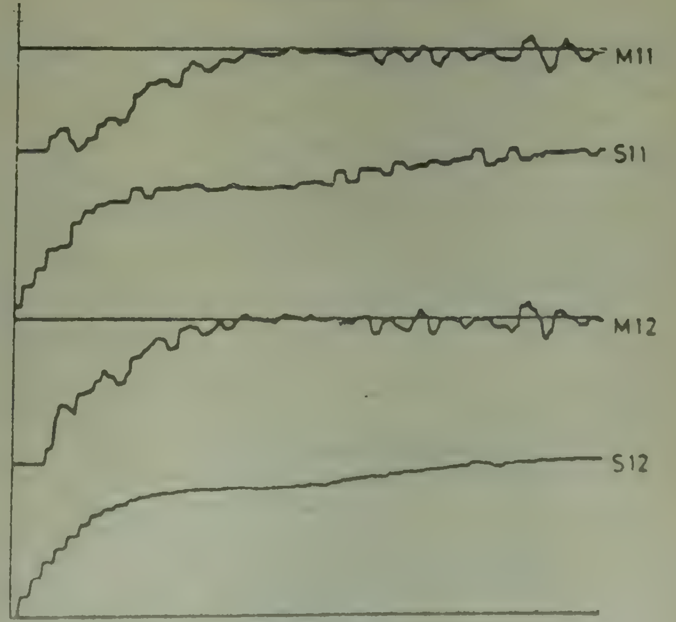
Responses of the form of Fig. 10 are normally considered too demanding on the plant actuators, and a more gentle control action is usually required. Fig. 11 illustrates the normalised control system responses, arising from unity



a no disturbance compensation



b with disturbance compensation



c with extra disturbance compensation

Fig. 11: Normalised control responses
S1, M11 milk density, 1174 to 1183 kg/m³
S11 chest pressure, 322.5 to 368.6 mbar
S2, M12 output flow rate, 229.8 to 305.3 l/h
S12 milk inflow rate, 1688 to 173 l/h

weightings for each signal. Figs 3.9a and b again illustrate the performance without and with disturbance signal compensation. In comparison with Fig. 3.8, there is much reduced control signal activity, with the penalty of slower responses to the set points. Fig 3.9c shows the effect of introducing additional feedforward compensation to bring the signal M11 closer to its setpoint.

Thus we have designed a multivariable control system with two inputs, two outputs in the presence of an uncontrollable disturbance signal. An achievment of which we can be proud .... but!

S12 is subject to a constraint of a maximum flow rate. This affects our controller thus:

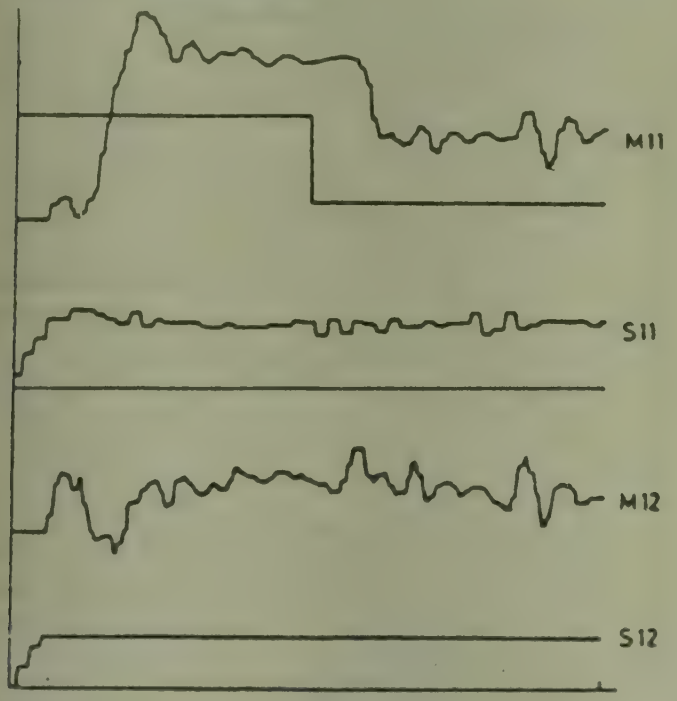


Fig. 12: Effect of saturation constraint on signal S12
S1, M11 milk density, 1174 to 1183 kg/m^3
S11 chest pressure, 322.5 to 368.6 mbar
S2, M12 output flow rate, 229.8 to 305.3 l/h
S12 milk inflow rate 1688 to 2173 l/h

Clearly this is not acceptable. The application of some engineering ingenuity solves the problem. Let us redesign our control philosophy. Thus:

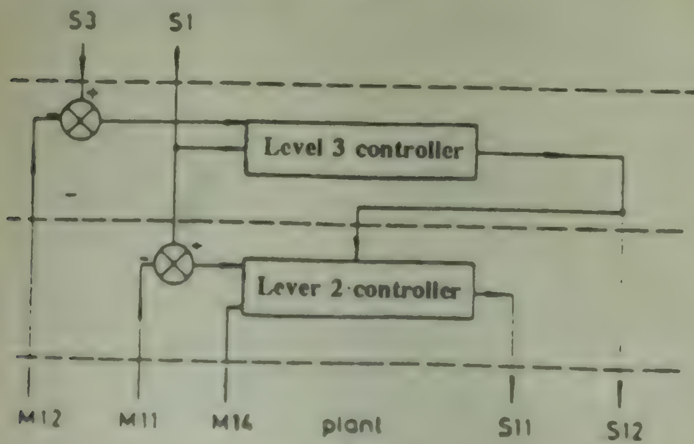


Fig. 13

The structure of control system to be developed is illustrated in Fig. 13. It divides into two levels, level 2 and level 3. At level 2, signal M11 is to be controlled. The setpoint S1, to the level 2 control system, is treated as a disturbance signal for the level 3 system. The control signal for the level 3 system is S12, the signal that is to be considered to be subject to constraint. The signal S1 is selected as a disturbance, rather than the associated measured signal M11, because, from the point of view of level 3 it is presumed tht the level 2 controller holds M11 close to setpoint, with little deviation. Note that this form of structuring can only be realisable if controller setpoints and actuations feed downwards through the level structure, as indicated in Fig. 14.

This structure has been chosen because it breaks the multivariable controller into two distinct portions. The signal S11 is now assigned to control the output M11. S12 is similarly assigned to M12. The incremental action of the level 2 loop, in combination with error feedback, will result in no steady-state error provided that S11 does not saturate. This is irrespective of whether or not S12 saturates. Compensation for interaction between the loops is now via the feedforward links associated with S11 and S12.

Not wishing to repeat myself, let me say that the same design processes were performed with this result (see Fig. 14):

Now we have designed a multi-level control scheme to overcome the plant constraint giving better performance than our straightforward multivariable controller.

Case Studies

Confidentially precludes details being given. But, here are some outlined case studies.

Varnish/Inks Manufacturer—the identificaton process revealed an unknown disturbance acting on the process and dramatically affecting the product quality. Investigation revealed that the temperature of the water supply to a cooling jacket was responding to ambient conditions (e.g. weather). A simple solution solved this product quality problem.

Cement Manufacture — reduced operating costs, particularly downtime resulting from replacing brick kiln linings, were achieved by getting tighter control of the process.

Detergent Manufacture — saved downstream packaging costs by ensuring less variability in product moisture resulting from tighter control of spray dryers.

Polymers Manufacture — expects faster grade changes to pay for investment in months.

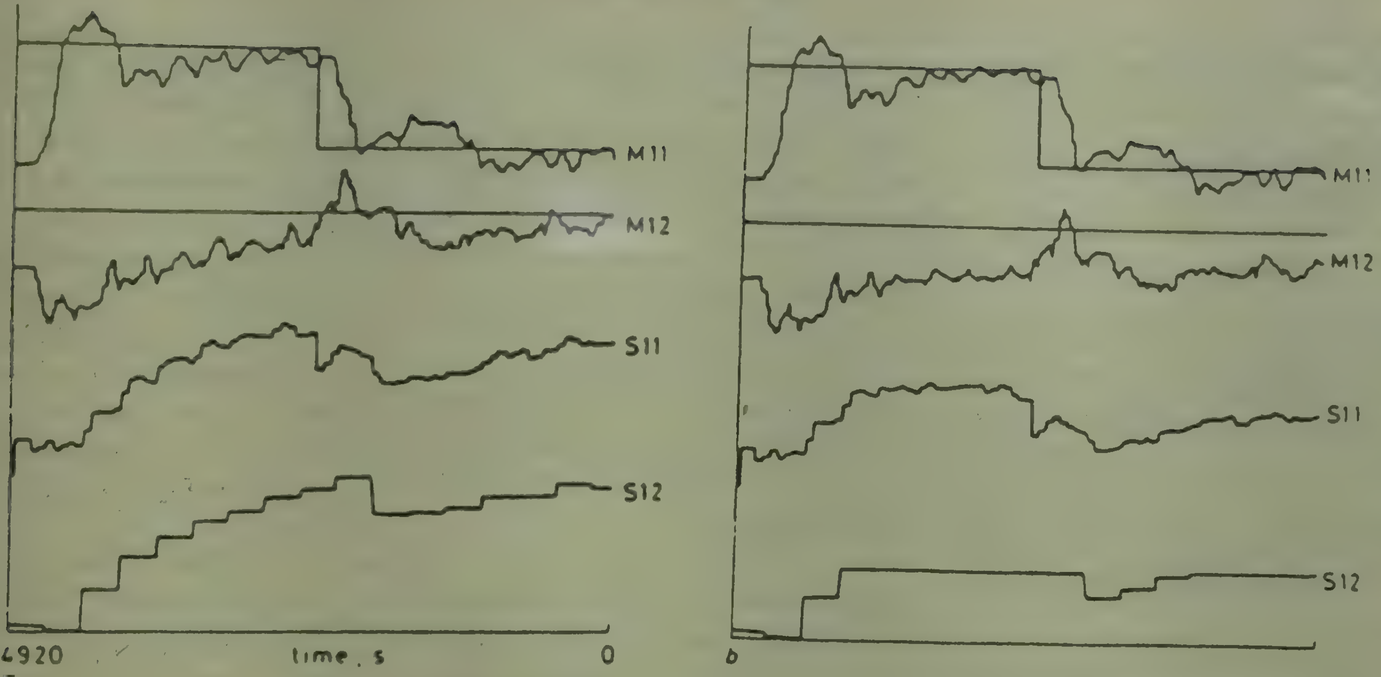


Fig. 14: Multilevel controller operation

a no saturation constraints
S1, M11 milk density, 1174 to 1182 kg/m^3
S11 chest pressure, 322.5 to 333.3 mbar

b saturation constraint on signal S12
S3, M12 output flow rate, 209.9 to 265.6 l/h
S12 milk inflow rate, 1685 to 1761 l/h

Application Criteria

These criteria would indicate when predictive control may be relevant.

From the technology:

-- interacting variables, including uncontrollable disturbances
-- time delays

From case studies:
-- product rather than process control.

Vendors

Predictive Controls Limited, in the UK are the only known exponent of this technology, but the market place has not been exhaustively researched. Other nominations are most welcome. Implementations are available on DEC's PDP-11 range and MODCOMP's realtime computer systems. A PDP-11 based implementation may cost as little as £50,000 for hardware and software.

An off-shoot of the UK's Cambridge University has something similar but it is believed to be less fully implemented.

CONCLUSION

Is PID dead?

Expert systems do not threaten the reign of PID as a control technology. Rather they are supportive. The implementation of an expert system will rely on the existence of a good conventional control system.

Predictive control, on the other hand, threatens PID on the margins of its territory. Where, if we are honest, we are currently using conventional control technology with poor results, predictive control may well solve our control problem and give the returns to justify the costs. But, until there are the large volume of sales for predictive control currently enjoyed by PID, then its unit cost must remain high by comparison to PID. PID will then remain cost effective, but only for straightforward control applications.

Chemical News from Abroad

EC STEPS UP PROBE INTO SODA ASH PRODUCERS

European Commission officials have sent statements of objection to European soda ash producers. The letters allege infringements of Articles 85 and 86 of the Treaty of Rome. Article 85 deals with potential anti-competitive deals and has been used for alleged cartel investigations in the past. Article 86 deals with abuse of dominant market positions.

ICI and Solvay had confirmed they were in receipt of statements of objection. West Germany's Mathes & Weber and Dutch chemicals giant Akzo confirmed they had not received letters from the commission. CF Kalk and Rhone-Poulenc were not available for comment.

Commission officials have been probing into Europe's $1.7 bn soda ash business for about 11 months. Last April commission officials raided the offices of the leading six European soda ash producers.

Concern from the commission focuses on the fact there is little movement of soda ash within the European community and that prices do not vary a great deal. Soda ash producers, however, claim they are in line with EC competition law and deny allegations of an entente.

West European soda ash capacity stands at about 7.255m ton/year, while production levels are around 6.3m ton. In recent years, the European soda ash business has been in the doldrums but has picked up in the past 12 months. Demand is currently outstripping production and only Solvay has any spot material.

Solvay, the Belgian producer, holds the lion's share of soda ash capacity with more than 63 per cent of available capacity. Nine locations account for some 4m ton/year. A spokesman for the firm confirmed it would continue to cooperate with the commission whose officials last year removed a stack of documents half a metre high. ICI, with about 1m ton/year between its sites in Winnington and Lostock, claims to be in full compliance with competition law and its legal advisers are now considering the allegations.

West Germany's Chemische Fabrik Kalk, a wholly owned subsidiary of Kali and Salz produces 300,000 ton/year at its plant in Koln, while Henkel subsidiary Mathes & Weber manufactures 280,000 ton/year at Duisberg. In France, Rhone Poulenc has a capacity for 550,000 ton/year at Le Madelaine, while the Netherlands' sole producer Akzo has 400,000 ton/year capacity at Delfzijl.

WAR BREAKS OUT AT ENIMONT

Montedison has initiated legal arbitration proceedings against Italy's state-owned Ente Nazionale Idrocarburi (Eni) in an attempt to reach a decision on the future of the Enimont venture.

Montedison said it felt "compelled to take this action in the wake of a long series of unfulfilled obligations and violations of the agreement on Eni's part, committed in an atmosphere of general and contrived conflict going against the spirit of the accords". Eni president Gabriele Cagliari recently went as far as to talk of "war".

According to an article in Enimont's founding agreement, whatever controversial issues break regarding the company, they must be dealt with amicably if at all possible, or else through three arbiters: one each representing Eni and Montedison and one neutral. These arbiters would have 90 days from the formation of the group in which to decide which part is in the right. Eni has countered Gardini's proposal for a L10,250bn ($8.1bn) capital increase with a suggested L4,000bn capital increase. Meanwhile, Gardini has called a meeting of Enimont's syndicate management committee, comprising three representatives each from Eni and Montedison, for March 27. Among the items on the agenda is the designation of Enimont's chairman, for which unanimous agreement is required.

BENCKISER BIDS FOR MIRA LANZA

As expected, Joh. A Benckiser is launching a public offer for the remaining shares in the Italian detergents producer Mira Lanza. It is also merging Mira Lanza, along with its wholly-owned subsidiary Panigal, with its Italian arm Benckiser Italia to create a company with a turnover of around L630bn ($503m). This restructuring will result in a company which counts among Italy's leaders in this sector.

The exact terms of the offer for the 23.62 per cent of Mira Lanza publicly owned shares will be announced after it has been approved by the Italian stock exchange authority Consob. However, the offer will be followed by a share swap deal, providing for the exchange of 11 shares in Benckiser Italia for each Mira Lanza share. To enable this, the company is to propose a capital increase from L58,000 bn to over L78,000 bn.

GERMANIES PLAN ANTITRUST RULES

The West German federal cartel authority, Bundeskartellamt, plans to establish a special section to deal with anti-trust questions arising from cooperation between companies in West and East Germany. East Germany is considering adopting West German statutes regulating conditions for competition. For the future, it is not clear whether East Germany will establish its own antitrust authority or whether Bundeskartellamt will extend its competency to East Germany.

Meanwhile, more West German firms have announced plans to cooperate with companies in East Germany. Chemical contractor, Deutsche Babcock Anlagen, plans to find a joint venture with VEB Wasseraufbereitungsanlagen in Markkleeberg. The new firm will sell water-treatment technology in East Germany and other East European countries.

The haircare products company Wella will set up a joint venture with VEB Londa, based at Rothenkirchen. The company, which claims to be Eastern Europe's leading producer of hair dyes, exports 70 per cent of production.

The two firms trace their origins to the same founder. Londa was nationalised in 1948. Wella said it expects the venture to create 100 new jobs in East Germany over the next two years. Hoechst has agreed to negotiate exclusively with VEB Kombinat Lacke & Farben over business ventures in East Germany. Plans include a joint venture to develop, manufacture and market coatings there.

EC/GCC AGREE TALKS

Agreement has been reached between foreign ministers from the EC and the Gulf Cooperation Council (GCC) that talks will begin in May aimed at concluding a free trade agreement between the two regions. This was the result of the ministers' first formal meeting, which took place in Muscat, Oman recently.

The EC commission authorities and the ministers were relieved that the expected antagonism between the two sides was absent and that the tone of the meeting was construction, given the open arguments and conflict which have dominated discussions on the issue.

However, representatives on both sides concurred that a free trade agreement between the EC and GCC would be very difficult to negotiate and may take around three years to finalise.

The two main stumbling blocks that remain are the absence of a customs union among the Gulf states, and GCC opposition to the European proposal that some "sensitive" petrochemical products should only be phased into the agreement over a period of upto 12 years.

TESSENDERLO CONSIDERS US FINE CHEMICALS BASE

Tessenderlo Chemie, the Belgium-based chemicals group, is considering the possibility of acquiring a US based fine chemicals company, said Alain Leemans, company director of business development.

"Although we are committed to the European market, we do believe that this business area could be reinforced through the purchase of a major facility in the US market", he said. However, in other fields he said the group was keen to remain predominantly European: "We understand European management and also, as we are a medium-sized company, with an expected turnover of $1.3m in 1990, it is vital that we remain loyal to our home market".

The company also has several other projects in the pipeline, especially in the minerals and alimentary products sectors. Leemans confirmed that Tessenderlo is about to sign two joint ventures in this area, one which is expected to be based on in-house technology and the other on acquired technology.

Looking towards Eastern Europe, the company currently has a number of advanced contacts with Hungary and is looking to develop its business further in the Hungarian and, possibly, East German markets. At present, about 2 per cent of the group's sales come from Eastern Europe.

Leemans said future developments are to be guided by the group's existing strategy of relying on its solid financial structure, good marketing skills and reinforced R & D. He also spoke of the possibility of moving into a completely new chemicals division, although it would have certain synergies with existing businesses.

Commenting on DSM's pull-out from the LVM project, Leemans said Tessenderlo was keen to continue the project singlehanded: the group will consolidate its downstream integration in PVC by further acquisitions. The previously announced third PVC unit on the Tessenderlo site is still under study.

Concerning the environment, Leemans said the company's commitment had been emphasised through the recent venture (EKOL) it established, in collaboration with the Belgian government, through which it is to recycle PVC at its Limbourg site. It is estimated that about 30 per cent of the group's total investments will be spent on environmental measures.

Tessenderlo reported net profits of 7.5 per cent on sales last year, but Leemans is expecting this to level out to 4-5 per cent for 1990.

SHELL BUYS IN FRG

Deutsche Shell's chemicals subsidiary Im-Tech acquired the West German plastics processor Kolbus Kunststoffwerk on April 1. Im-Tech is intending to develop and expand the production of specialised parts for the automotive and electronics industries through this acquisition. It also intends to boost further the fibre-reinforced thermoplastic parts business, as well as the production of structural composite parts using the reaction injection moulding process.

Kolbus produces high-performance moulded parts from sheet moulding compounds and bulk moulding compound materials, as well as injection moulding resins and fibre-reinforced thermoplastic sheet.

Chemical Markets Abroad

EUROPEAN PET PRODUCERS SEEK FURTHER PRICE RISE

ICI has announced an increase in the price of Melinar, its range of PET polymers. With effect from 1 April, ICI's price for standard two-piece bottle grade polymer will increase to a minimum West European delivered price of £1,040/ton ($1,674/ton). This constitutes roughly a 10 per cent price increase in Q1 prices.

Hoechst is also posting a price rise of the same order and Eastman Kodak is looking for a price hike of £80/ton to £1,040/ton as the European market for PET becomes progressively tighter. Price hikes of a similar order in Q1 were generally successful.

There are several factors behind this shortage. Demand continues to grow strongly in Europe. In 1989, growth was around 20 per cent and some industry observers believe this could be repeated in 1990, although the consensus industry figure is probably somewhere in the low teens.

Warm weather is one factor behind seasonally high demand. Although the growth of the two-litre carbonated drinks market has probably slowed down to around 10 per cent, other areas have begun to show rapid growth —notably, the high end quality of the food and drinks clear packaging market and the strong growth in demand for bottled mineral waters, where PET will almost certainly gain market share against PVC as a result of environmentalist concern over the use of this material.

Substitution for other materials is probably the principal driving factor behind PET growth. To a certain extent European price increases will temper this effect. In the US, falling raw material prices and poor capacity utilisation, which had fallen below 70 per cent of Q4 1989, lead to price decreases which are believed to have successfully stimulated further substitutions for glass and aluminium containers. The US has experienced a surge in PET demand in Q1 which could even lead to seasonal tightness in the summer months.

Currently, the European industry is in a very different position to its North American counterparts. Industry sources suggest that capacity utilisation is closer to 90 per cent of nameplate and that the ability to adjust production upwards is very limited. New investment has not been an option because of the low profitability of PET over the past two years as a result of the very heavy increases in feedstock prices in 1988 and 1989.

Purified terephthalic acid (PTA) prices rose fairly gradually in 1988 and 1990 to around DM1,550/ton. Since then, however, the price has fallen back to around DM1,320-1,350/ton. The price increase in MEG was much more dramatic, doubling from around DM1,000/ton to DM2,000/ton in mid-1989 before gradually falling back to the current level of around DM900-950/ton.

PET margins werre eroded by these price increases to the extent that it appears unlikely that the industry was profitable when raw material prices were high. Nevertheless, falling raw material prices have brought relief. The mood of PET producers currently suggests that new investment to relieve the tight position of the European PET market will depend on acceptance of these new price increases and the understanding that future raw material price increases would require further upward adjustment. Without these assurances they believe that new PET investment in Europe is not an economic proposition.

There are, however, alternative sources of product for the European market. West Europe will be a net importer of polymer in 1990 with perhaps 10 per cent of demand satisfied by imported product. Currently Far Eastern producers are very active in the market, offering product in larger size than has previously been seen and negotiating contracts with European consumers. PTA is in abundant supply because of poor demand from the Pacific Rim polyester fibre industry and prices are low leading to very competitive PET price tenders from the Far Eastern producers.

The low capacity utilisation of the US industry could also result in some net export to Europe to satisfy converter demand and take advantage of the higher price levels. If this happens, the prospects of the price initiatives succeeding must be doubtful and leave in question further investment in European capacity at this time.

Industry sources believe that customers will accept the increases in return for a firm commitment on available volumes and quality standards from the producer.

PET resin major producers — Western Europe

	'000 ton
ICI	72
Montefibre	55
Eastman	50
Enichem	48
Hoechst	40
Akzo	35

BOC STARTS DUTCH GASES UNIT

BOC's industrial gases plant at Terneuzen, the Netherlands, has been commissioned six months ahead of schedule. The £30m ($18.6m) plant is situated adjacent to Dow Chemical's complex and is contracted to supply Dow with high purity nitrogen and oxygen over the next 15 years, the gases supplied direct to the plant by pipeline.

Plant capacity is in excess of 1,000 ton/day and, in addition to supplying

Dow's requirements, the plant will be an important source of liquid nitrogen, oxygen and high purity argon for BOC's customers in Benelux, West Germany and France.

It provides a much desired continental base from which to build BOC's European sales. Prior to the commissioning of the Terneuzen unit, BOC's only real presence in Europe was a 25 per cent share in the West German electronic gases market.

STYRENE PRICES SOAR AHEAD OF Q2 CONTRACTS

Styrene appears to be a very active market, ahead of Q2 contract settlements. The European spot price has surged during March. At the end of February, T1 was quoted at $770-790/ton cif and T2 at $800-840/ton fob. Currently both prices are quoted at $1,120-1,150/ton.

Producers claim the styrene supply situation is very tight. Shell's 308,000 ton Canadian plant had been down for two weeks, but was scheduled to restart on 23 or 24 March. Exports to the Far Eastern markets which normally comprise sizeable part of its business had to be satisfied from Europe.

The Sadaf plant at Al Jubail, with a capacity of 360,000 ton/year, was closed for routine maintenance for four weeks and has experienced difficulty coming back up to full production and is operating at less than 80 per cent of the nameplate capacity, according to industry sources. Prior to the planned shutdown, the plant was said to be operating well in excess of nameplate.

US styrene producers have also experienced difficulties coming back to full production after the outages caused by the cold snap, but these appear to be resolved and US material should once again be appearing on world markets. Dow and BP are scheduled for shutdowns for four weeks in April. Both producers have been buying product in the marketplace. Huntsman and Arco are involved in plant closures in the US, and several Far Eastern plants are said to be involved in shutdowns over the next few weeks.

Derivative demand is said to be ahead of expectations. Polystyrene accounts for 70 per cent of European styrene production and the PS market has been firm with the packaging and electronics sections strongest. However, PS producers failed to achieve general acceptance of the price hikes attempted in the first quarter and it seems unlikely that further attempts to lift the price level will be made in Q2. PS producers will be unwilling to readily accept any settlement of styrene Q2 contracts above the Q1 level of DM1,700/ton.

Buyers will point to the purchases of European producers as a major factor behind the surge in the styrene price in March and suggest that tightness in the European market was not as acute as the price movement suggests.

METHANOL CONTRACT IDEAS EMERGE

While the Rotterdam spot scene remains quiet, European methanol producers appear resolved to push through a contract price hike for quarter two of at least DM20/ton.

They argue that European prices have been left behind by higher contract numbers in the US and in Japan, and that the lower indications from Rotterdam are not underpinned by sufficient spot volumes. For those operating through Rotterdam, an additional Dfl.2.70/ton charge, resulting from stricter environmental legislation, is being passed on from storage companies to European suppliers.

Their case may be strengthened by the squeeze on supply which has been felt by consumers. They have had difficulties in physically securing supplies, due to fluctuating Rhine water levels. Now, while Malaysian material is redirected to Indonesia in the light of local start-up problems, the scheduled turnarounds for Soviet and German units are impending. Meanwhile, Brazil has been importing some 200,000 ton in the last four months, as the input of methanol into a 33 per cent automotive fuel mix (with 60 per cent of ethanol and 7 per cent gasoline) is expected to continue.

North American and Chilean suppliers to Brazil have been swapping with European players.

NON-OIL FUEL SHOWS FUTURE PROSPECTS

Road transport's oil consumption will be cut down if natural gases, methanol and synthetic gasoline remain competitive as is hoped. But the change to alternative fuels will require significant environmental research and development.

These are the conclusions of the study Substitute Fuels for Road Transport: A Technology Assessment published by the International Energy Agency in Paris. Natural gases, alcohols and very heavy oil products are reviewed and their market prospects are forecasted to the year 2005.

Methanol use will present difficulties connected with its toxicity when inhaled and will require special storage tanks and nozzle distribution systems. A longer-term goal remains the development of engines that will make full use of alcohol's clean burning properties.

Compressed and liquefied natural gas will present a particularly attractive option for economies like Australia and New Zealand, with limited oil but substantial gas reserves. The study estimates natural gas's cost as fuel at $20-46/barrel (1987 dollars) of gasoline equivalent. Development costs will here be focused on lowering storage costs (by looking into lighter weight tanks and higher density storage mechanisms).

Environment

LENTJES AND BABCOCK OFFER CUTS IN DIOXIN EMISSION

The environment ministry in the West German state of North Rhine-Westphalia has launched a DM2bn ($1.2m) programme to modernise waste incineration facilities. One of the major goals is to reduce dioxin emissions to the air.

Environment minister Klaus Matthiesen said the state will reduce allowable levels for dioxin in plant emissions to 0.1 nanogram/m^3 of air, with the new rules applicable to existing plants and new facilities.

Although the minister said he is convinced that new processes developed by engineering firms Lentjes and Deutsche Babcock will reduce emissions to this level, only Lentjes has stated categorically that its process works in long-term operation.

The Lentjes counter-current process, based on absorption by activated charcoal, has been chosen by the city of Dusseldorf to upgrade a municipal incineration facility and has been tested at the pilot scale. Lentjes claims its process reduces dioxin emissions to 8,000g/year, or 0.1ng/m^3 of air.

The technology developed by Deutsche Babcock concentrates on changing the firing arrangement in the furnace. The company says its tests have shown the process can cut dioxin output measured at the end of the furnace by up to 10 times. Current emission levels range from 10 to 30 ng/m^3.

A special catalyst to be installed directly in front of the flue, part of the obligatory equipment for de-nox of exhaust gases, can also burn dioxin catalytically, according to Babcock. The company adds that dioxin emissions can be reduced by more than 80 per cent at this stage, without creating new residues.

Deutsche Babcock is also working on the development of an activated carbon adsorption technology. However, the company said it sees "several problems" concerning safety engineering and disposal of residues.

Meanwhile, Klaus Topfer, West Germany's federal minister for the environment, has announced that companies from the Federal Republic investing in anti-pollution projects in the GDR will receive credit against waste water levies at home.

In East Germany, the environment ministry has developed a long-term concept for reducing pollution. According to Peter Diederich, environment minister until recent elections, a "comprehensive ecological restructuring programme" will include penalties for ecological offences and introduce laws calling for prevention of pollution. The "polluter pays" principle will be adopted.

LURGI FORMS EAST GERMANY JVS

Lurgi, the Frankfurt-based engineering subsidiary of Metallgesellschaft, has founded a joint venture with East German company Ilka Luft und Kaltetechnik, based at Dresden, and Umwelttechnik/Luftreinhaltung, based at Leipzig. The venture will pursue projects in dust pollution control and waste gas treatment for industrial plants in the GDR.

The contract was signed at the Leipzig trade fair. The new firm will have its headquarters in the same city. Also at the fair, Lurgi signed an agreement with the GDR ministry for nature conservation, environmental protection and water management to provide assistance with drinking water purification at water works throughout the country.

Although the maximum limit for nitrate pollution of GDR drinking water is set at 40mg/litre, actual concentrations in some areas are believed to run as high as 420mg/litre.

Another contract for Lurgi encourages cooperation with the GDR gas company, Fritz Selbmann Schwarze Pumpe, to provide technical expertise in coal gasification, liquefaction and related technologies, plus environmental protection technology.

NITRATE REDUCTION WITH $CaSO_4$

An independent researcher in France is trying to persuade water-treatment companies of the efficacy of his patented invention for reducing nitrate levels in drinking water. Etienne Tillie has the backing of the dean of the Nice faculty of science in southern France and has shown his process works in small-scale tests.

The process consists of adding sulphuric acid to calcium phosphate to obtain both phosphoric acid and a mineral waste, calcium sulphate, which contains no phosphate. The calcium sulphate forms the basis of the physico-chemical reaction in nitrate-containing water. On contract, the nitrates react and crystallise out. Economic results have been achieved in experimentation and Tillie is now trying to market the invention. Installation of the process on existing water treatment plants should add only around 6 per cent to the cost of a station.

KEMIRA PROPOSES BALTIC CLEAN UP

State chemicals company Kemira has presented the Soviet Union with an environmental report outlining possible joint Fenno — Soviet initiatives for effectively tackling pollution in the Gulf of Finland while reducing the level of pollutants entering the Baltic Sea. The project was initiated by Kemira's ceo Yrjo Pessi.

The Baltic's pollution problems are compounded by a lack of infrastructural investment in water treatment plants in Estonia, Poland, East Germany and the Soviet Union. A Baltic Commission meeting, held in Helsinki in February, found untreated industrial and municipal waste to be the biggest sources of pollution. The Nordic Investment Bank (NIB) is now offering Baltic states soft credit terms to up pollution control.

Recent internationally commissioned environment reports all point to the Baltic's deterioration, indicating that sea water quality is in decline. The NIB has estimated the total clean-up cost at around £3-4 bn ($4.8-6.4bn). "£1.9bn would be required to clean-up the Gulf of Finland alone. About 25 per cent of this would be in Western currency. The other 75 per cent of capital would be provided by the USSR, which would take responsibility for the heavy construction work", said Juhani Tuomarla, a director at Kemira's Kemwater Unit.

The report details how drainage and improved water cleaning facilities in the more industrialised areas around Leningrad, Karelia and Estonia could dramatically reduce the flow of pollutants into the Baltic. Kemira has offered Baltic states the necessary technology to upgrade their water treatment facilities.

"We have already started discussions with the Leningrad authorities and our proposal to start full-scale tests in Leningrad have in principle been approved. We are now ready to begin wastewater treatment tests in April. It will test the ability of our chemical processes and enable us to improve on them", said Tuomarla.

Apart from equipment deliveries, Kemira's technology will include advice on the removal of nitrogen from effluents by the introduction of chemicals for pre-precipitation before existing biological treatment plants.

The Kemira report sets out a five-phase schedule extending to the year 2004. The initiative is now being discussed at an inter-government level as one of several joint venture proposals.

Finland has offered £240 million in soft loans and £50 million in interest supports to help modernise mining and chemical industries on the Kola Peninsula, a major source of cross-border pollution impacting negatively on the ecology of Lapland and threatening Finland's forests, the backbone of its economy.

EP TALKS MAY DELAY ENVIRONMENT AGENCY

Calls from the European Parliament to discuss plans for a European environmental agency with the Council of Ministers could delay establishment of the new body. MEPs have given their opinion of the Commission's plans and wish to explain their amendments to the proposal to the EC environmental council.

The European Parliament is seeking three amendments to the proposal, concerned with making sure the agency is not limited to data collection but can take a proactive role.

While Commissioner Ripa di Meana supports the call for talks, there is a danger these could delay the agency's establishment. The parliament is entitled to ask for talks with the Council of Ministers but the latter is not obliged to comply with the request because the budgetary implications are not great enough to warrant it.

Nevertheless, EC sources suggest it may not be wise of the council to refuse the request. The council was due to discuss the agency's establishment at its meeting on March 22.

With MEPs putting pressure on the council it seems unlikely a decision to proceed with the agency will have been made. This means the subject will be postponed until 7 June 1990 when EC environment ministers are next scheduled to meet.

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Technological Scene Abroad

AMOCO OPTIMISTIC OVER PP LICENSING PROSPECT

Amoco's decision to license its improved PP technology will take it into a very competitive sector of the petrochemcials market. But Steve Welch, Amoco's vice president of marketing for polymers, believes that the process and catalyst he is offering can compete with existing technologies in terms of both capital and operating cost. In addition, he says, "We are better on quality, transition time and catalyst. We think we have a winner".

The high-yield catalyst used is a fourth generation product manufactured by Amoco itself. It has controlled morphology and high activity and like other advanced catalysts does not have to be removed from the process stream.

Amoco's process, developed with Japanese licensee Chisso, uses a gas-phase reaction in a horizontal sitrred bed reactor which, the company says, comes clsoe to plug-flow operation. This, explains Welch, allows the operator to switch from one product to another with a short transition time. The technology allows a full range of PP types to be produced — homopolymer, random copolymer and impact grades.

The process uses two reactors with recycle of monomer from the second to the first. These are said to be energy efficient and safe as they contain less propylene than other reactor types. Energy efficiency is also improved by using evaporation of the liquid propylene for cooling purposes. The smaller volume of propylene in the reactor also has a positive safety aspect, says Amoco.

Although intended primarily for use in new gas-phase reactors, Amoco's improved high yield catalyst can also be retrofitted into existing slurry-based process. Amoco will carry out this changeover on its own slurry units in the US and Geel, Belgium, over the next 2-3 years. But the possibility of conversion is particularly appropriate to producers in Eastern Europe, where older plants can be made more cost competitive, says Welch. Switching existing slurry units to the new catalyst eliminates several steps in the production process and reduces the requirements for recycling.

Amoco is running its licensing operation out of Chicago and is already talking with a number of undisclosed customers. With Himont (Spheripol), BASF (Novolen) and Union Carbide (Unipol) well established in the market, Amoco will have its work cut out, but Welch confirms the company "will compete head to head" in the marketplace. Welch sees a bright future for PP and believes the construction of plants will not diminish over the coming 5-10 years. "In fact, it may accelerate", he says.

GOLDEN FUTURE FOR SN POLYMER

Researchers at Durham University in the UK have developed a safe way of making poly (sulphur nitride), a material attracting attention from the Japanese electronics industry because of its potential as a conductive polymer. It can be used as a replacement for gold in light-emitting diodes and as light-weight electrode material for batteries and solar cells.

The process uses specially developed equipment to electrolyse S_5N_5 salts in liquid SO_2. The salts take the form of a positively charged, 10-member ring. On electrolysis, the S_5N_5 ring structure breaks open to form chain molecules of poly(sulphur nitride). These can be deposited on to such surfaces as metal or glass.

With double bonds all the way down the spine of the molecule, poly(sulphur nitride) is a very good conductor and becomes a superconductor at a temperature of 0.27 Kelvin. Before the new process was discovered, the polymer could only be manufactured from tetrasulphur tetranitride (S_4N_4) which is highly explosive.

The electrochemical equipment designed for the process is a significant development in itself, says Arthur Banister, head of the research team. The cell can be used for any non-aqueous solvent and has an electrode potential stability of ±0.3mV during short-term operation. Poly(sulphur nitride) tarnishes slowly in air to give a surface layer of elemental sulphur. But, says Banister, this would not prove a problem in enclosed electronic systems.

ASIA MOVE FOR LION

Lion Corp. is drawing up plans to boost its technology transfer operations to South East Asia. The firm intends to set up a technical centre within its International division at its Tokyo headquarters. But it intends to shift this centre to its Singapore-based subsidiary within 12 months.

The company believes it necessary to set up a base in the region to meet local technical demands. The centre will first be staffed with specialists in detergents, perfumes and cosmetics and packaging.

ARGENTINE DEBUT FOR CYANAMID'S CYDECTIN

American Cyanamid has chosen Argentina to launch its Cydectin endectocide, active against both internal and external parasites, especially mange, in cattle.

The active ingredient, moxidectin, is produced by a combination of fermentation and chemical synthesis. After isolation and purification it is chemically modified to achieve a wide spectrum of endo- and ectoparasitic activity.

Cyanamid has built a multi-million dollar manufacturing plant at Florencio Varela just outside Buenos Aires to produce and formulate the compound. The company intends to market Cydectin in other Latin American countries and global markets as it receives registrations, initially using the Varela plant for export.

Cydectin represents Cyanamid's first entry into the endectocide market, but as Cyanamid says: "We are now solidly in the world market for simultaneous treatment of external and internal parasites". The company has tested moxidectin, which has novel chemistry, against the existing ivermectin, finding it to have certain advantages. Cyanamid claims it clears mange lesions more quickly, is less irritating at the injection site and controls helminths effectively.

ENERGY CUT IN SYNGAS ROUTE

Energy savings of between 30 and 50 per cent are claimed for a selective oxidation process to generate synthesis gas from methane or natural gas.

Researchers at Oxford University in the UK have developed a ruthenium oxide catalyst which could enable a selective oxidation process to be used instead of traditional steam reforming. They have published their results in the science journal Nature.

Synthesis gas is a mixture of carbon monoxide and hydrogen and is used as a feedstock in ammonia and methanol production. Conventional steam reforming over a nickel catalyst at 700 to 800°C is highly energy intensive because the reaction is endothermic. The carbon monoxide also tends to be converted to dioxide by the steam.

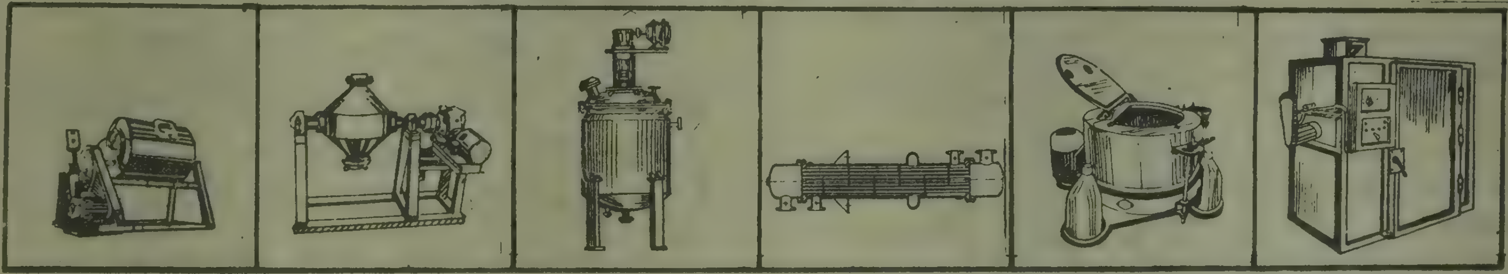
The partial oxidation process in contrast is mildly exothermic and exhibits a selectivity up to 99 per cent. No steam is needed and the reaction takes place using gaseous oxygen or air at a pressure of around 20 atmospheres.

Professor Malcom Green has worked on the project and says: "It is not as golden as it might sound, because when it comes to real world situations, it may be that the ratio of hydrogen to carbon monoxide is not right for a particular application".

The ratio of CO to H_2 achieved is higher with selective oxidation than with steam reforming. But secondary reformers are often needed to reduce the hydrogen content of synthesis gas from steam reforming. So, the low hydrogen content is seen as another potential advantage of oxidation.

The mixed oxide of rare earths and ruthenium is more expensive than the nickel-based catalysts used in steam reforming. But the catalyst should only need replacing every five years.

WE DESIGN AND MANUFACTURE



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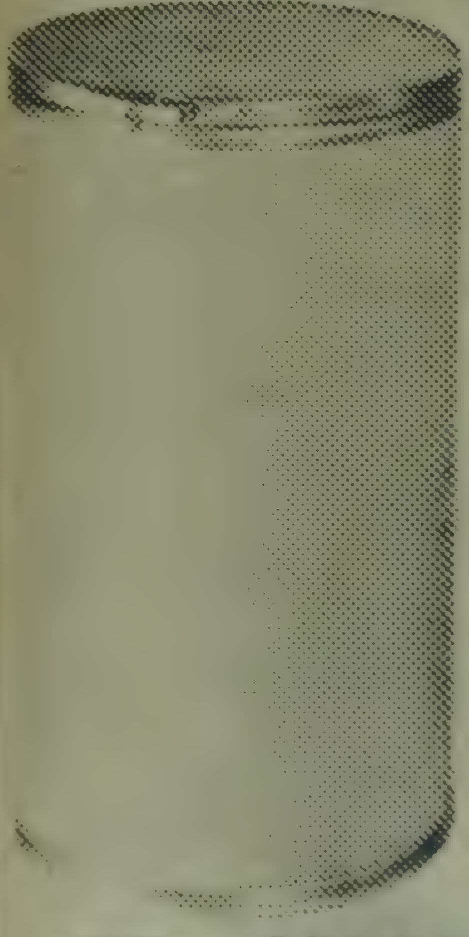

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CAPACITY :
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MARKET INFORMATION

Prices of Sodium Nitrite Shoots Up

We cannot guarantee the accuracy of the prices published in CHEMICAL WEEKLY as they are based only on the enquiries made by our correspondent – and, as such they are not FIRM PRICES as between a buyer and seller. The prices are published only with a view to giving some ideas of the market conditions.

The prices are inclusive of Excise and Maharashtra Sales Tax.

Prices of sodium nitrite shot up in the Bombay chemicals market to Rs. 3,600 per 50 kg owing to sharp increases by the prominent manufacturer of the chemical. Even at this price, the commodity was not readily available.

Hydrogen peroxide was in short supply even at Rs. 38. HOC the manufacturer of PNCB increased the price to Rs. 60. Intermediates exhibited a downward trend. All other items were traded at their previous levels.

(Prices as on May 15, 1990)

INDUSTRIAL CHEMICALS	Per Kg.
Ammonium sulphate	2.50
Ammonium phosphate (Mono)	14.50
Ammonium phosphate (Di)	14.50
Ammonium carbonate (Di)	17.00
Ammonium bicarbonate	6.00
Ammonium chloride	3.25
Ammonium nitrate	6.00
Arsenic white powder	22+ST
Acrylamide (Resale)	72.00
Barium carbonate	13.00
Bleaching powder (33% Cl)	5.00
Borax (Granular)	17.50
Borax (Powder)	22.00
Boric acid (Tech)	26.00
Bisphenol-A	82.00
Butyl carbitol	110.00
Caustic soda (Flakes)	12.50
Caustic soda (Solid)	12.00
Caustic soda (Lye)	10.00
Calcium chloride 70% (Solid)	3.25
Calcium chloride 75-80%(fused)	3.50
Calcium chloride 36% (Anhydrous)	5.00
Calcium carbonate (precipitated)	6.00
Calcium carbonate (Activated)	5.75
Cobalt oxide	300.00
Cresylic acid	62.00
Camphor (Indian)	105.00
Cream of Tartar (Tech.) China	70.00
Citric acid (Belgium) (Resale)	47.00
Citric acid (Indian) (Resale)	44.00
Copper sulphate	26.00
Chromic acid	63.00
Ethylene urea	58.00
Ferric chloride (Lumps)	5.50
Ferric chloride (Anhydrous)	16.00
Glue flakes	15.00
Glue sheets	6.75
Gohsenol GH-17	125.00
Hydro	39+ST

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Menthol bold	425+Ex+ST
Menthol crystal cold	395+Ex+ST
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Magnesium carbonate (Indian)	26.00
Maleic Anhydride (Resale)	42.00
Mercury (34.5 Kgs)	11,500.00
Nickel chloride	110.00
Oxalic acid (Resale)	15.50
Peppermint oil (Rectified)	188+Ex+ST
Potassium carbonate (Indian)	26.00
Potassium carbonate (Imported)	36.00
Potassium bichromate	33.00
Potassium phosphate (Mono)	34.00
Potassium phosphate (Di)	25.00
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Polyvinyl alcohol (No. 173)	125.00
Polyvinyl alcohol (No. 208)	150.00
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Phthalic anhydride 36% (Resale)	27.50
Pentaerythritol (Resale)	49.00
Paraffin wax	22+ST
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Rangolite (Czech.)	72.00
Rangolite (China)	55.00
Sodium sulphate (Fine)	3.75
Sodium sulphate (Coarse)	3.50
Sodium sulphide 50-52% (Flakes)	11.50+ST
Sodium sulphide 58-60% (Flakes) (TCL)	25.00
Sodium sulphide pure (Flakes)	12.25
Sodium nitrite (Resale) per 50 kg	3,600.00
Sodium chlorite 80% (Spain)	110+ST
Soda Ash (Tata)	4.90
Soda Ash (Birla)	4.30
Soda Ash (Imp.)	4.50
Sodium bicarbonate	7.00
Sodium bisulphite	8.00
Sodium silicate	5.50
Sodium acetate	7.20
Sodium alginate	450.00
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Titanium Dioxide (Rutile – RCR_2)	92+ST
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Urea (Tech.)	3.00
Vacuum salt	1.00
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Zinc Oxide	57.00
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Zinc sulphate	7.00

SOLVENTS	Per Kg.
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Benzoyl chloride	22.00
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Cyanuric Chloride	142.00
2,4- DNCB	29.00
Dihydrothio PTOS (Imp.)	1,000.00
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Diethyl Aniline	150.00
Diamino stilbene disulphonic acid	155.00
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Sulphanilic Acid	33.00
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Trichloro Benzene (TCB)	24.00
Tobias Acid (Imp.)	145.00
Metanilic Acid	44.00
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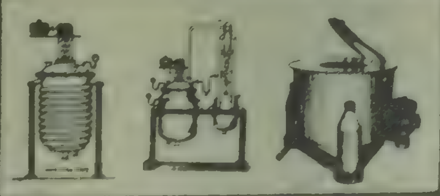

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Bombay Dyes Market

(Prices as on May 15, 1990)

ACID COLOURS	Per Kg.
Acid Violet 4BS	*190.00
Acid Maroon V	110.00
Acid Orange II	112.55
Acid Orange IIY	93.85
Acid Red A	137.00
Acid Scarlet 3R	128.35
Acid Red 3BN	*195.00
Acid Red R2R	132.00
Acid Red RS	88.00
Acid Patent Blue AS	*280.00
Acid Green V	*375.00
Acid Coomasi Blue	200.00
Acid Yellow 5GN	65.00
Acid Red PG	85.00
Acid Red GRS	78.00
Acid Black 10 BX	157.15
Acid Black BX	126.95
Acid Black Wax	135.50
Crosein Scarlet MOO	200.30
Procinil Yellow GS (ICI, UK)	265.00
Procinil Red GS (ICI, UK)	530.00
Procinil Blue RS (ICI, UK)	315.00
Procinil Scarlet G (ICI, UK)	600.00
Procinil Orange G (ICI, UK)	250.00
Procinil Rubine (ICI, UK)	550.00

* To get resale price add 6% tax

DIRECT COLOURS	Per Kg.
Yellow 3GX	114.00
Gun Yellow RCH	175.85
Fast Yellow GCH	171.5C
Yellow CFG Hly. Conc.	721.00
Fast Yellow GS	126.96
Fast Yellow CHRS	116.85
Viscose Orange A	210.35
Fast Orange GR	171.50
Red	122.65
Dark Tan	98.15
Red IIR	98.15
Red 4B	217.55
Bordeaux BW	170.10
Fast Scarlet 4BS	223.50
Red 12B	220.45
Bordeaux Hly. Conc	249.20
Cotton Red N	117.06
Brill. Fast Helio B	362.85
Brill. Fast Helio 2R	385.85
Brill. Fast Helio 2RS	177.30
Brill. Fast Helio BS	116.10
Brill. Violet Extra	181.45
Blue 2B	102.50
Blue G	220.45
Sky Blue FB	242.00
Copper Blue GR	190.25
Fast Greenish Blue GL	114.60
Developed Black BT	149.95
Blue NB-2B	348.45
Blue NB-2BG	214.70
Developed Black NB-GHB	214.70
Green B	142.75
Green NB-B	218.90
Green 2B-N	218.90
Brown MR	197.40
Brown CN	137.00
Golden Brown G	175.85
Catechin G	155.70
Omega Tan	161.45
Catechin GS	102.80
Black E Hly. Conc.	180.15
Black E Extra Hly. Conc.	180.15
Black NB-ER Hly. Conc.	290.50
Red 2B	422.40
Red FB	425.80
Red Violet FBL	622.00
Orange 3R	254.20
Violet 3R	370.50
Violet RL	355.70
Violet 6R	638.20
Scarlet RR	283.50
Rubine 3B	289.10
Rubine CB	449.50
Blue GL	419.00
Blue BGF	805.80
Navy Blue RE	359.90
Brown 3REL	272.80
Black GEL	420.10
Dark Brown 3B	411.10

DISPERSOL COLOURS	Per Kg.
Red B 3B Conc	611.50
Red B 2B Conc	797.90
Red CB Powder	1048.25
Red D2B Powder	599.85
Violet C 4R Conc.	1202.70
Blue BG Conc	580.65
Blue BN Powder	128.20
Blue D 2R Powder	586.25
Navy BT Conc	531.95
Blue B 2G Conc	577.95
Black BT Conc	319.50
Blue BR	482.40
Yellow 7GL	813.20
Yellow 5RX	269.90
Yellow 3G	473.20
Yellow	140.00
Yellow AL	167.20
Yellow Brown REL	311.70
Yellow FFL	571.40
Gold Yellow GG	320.80
Pink REL	593.00
Red BEL	615.60

BASE COLOURS	Per Kg.
Fast Yellow GC	77.75
Fast Orange GC	128.40
Fast Scarlet R	198.05
Fast Scarlet RC	128.40
Fast Scarlet RCR	105.60
Fast Scarlet G	115.75
Fast Scarlet GN	92.95
Fast Scarlet GG	77.75
Fast Scarlet GGS	73.95
Fast Red B	233.50
Fast Red RC	115.75
Fast Red R Flakes	158.80
Fast Red TR	181.60
Fast Red TR Oil	223.35
Fast Red RL	251.20
Fast Red KB Oil	251.20
Fast Bordeaux GP	236.00
Fast Garnet GBC	103.05
Fast Violet B	548.80
Fast Blue BB	566.50

NAPHTHOL COLOURS	Per Kg
ASG	301.85
AS	305.65
ASSW	379.10
ASBS	253.75
ASBO	266.40
ASD	209.45
ASOL	243.60

Bombay Drugs Market

Prices as on May 14, 1990

Product	Rs./kg.
Acetazolamide IP	700.00
Acriflavine BPC	850.00
Aluminium Hydroxide IP	36.00
Ampicillin Trihydrate	1660.00
Aminophylline	335.00
Albendazole	2050.00
Analgin	240.00
Aspirin IP	85.00
Atenolol	2900.00
Benzoic Acid IP	35.00
Bromhexine HCl	2400.00
Caffeine Citrate IP	275.00
Caffeine IP	285.00
Calcium Gluconate IP	48.00
Calcium Glycerophosphate	160.00
Calcium Lactate	40.00
Calcium Phenthonate	600.00
Cetrimide IP	200.00
Chloramphenicol Powder	1400.00
Chlorbutol	95.00
Chlorhexidine Gluconate 20% BP	210.00
Chloroquin Phosphate	875.00
Chlorpromazine HCl	1550.00
Choline Chloride FG	30.00
Choline Chloride IP	55.00
Citric Acid IP	40.00
C.P. Maleate IP	1150.00
Dapson IP	280.00
Dexamethasone	90.00
Dicyclomine HCl	1550.00
Diethyl Carbamazine Citrate	250.00
Di-iodohydroxyquinoline	560.00
Diloxanide Fumarate IP	370.00

Product	Rs./kg.
Dimetridazole	280.00
Diphenhydramine HCl	260.00
Disodium Hydrogen Citrate	80.00
Ephedrine HCl	1750.00
Erythromycin Stearate	2075.00
Ethambutol IP	925.00
Fenbendazole	3000.00
Ferrous Fumarate	40.00
Folic Acid IP	3500.00
Furosemide IP	1900.00
Furazolidone IP	355.00
Guanidine Nitrate	40.00
Gallic Acid	300.00
Haloperidone	19,000.00
Hematropine Methyl Bromide	9.25
Hydrazine Hydrate	83.00
Ibuprofen IP	385.00
I.N.H.	260.00
Inosite IP	925.00
Iodochloro	490.00
Lactose IP	37.00
Lactic Acid	90.00
Lignocaine HCl	325.00
Lignocaine Base	325.00
L. Lycine Feed	140.00
L. Lysine Pharma	250.00
Magaldrate IP	46.00
Magnesium Hydroxide	22.00
Magnesium Trisilicate IP	10.50
Mannitol USP	100.00
Mebendazole	610.00
Mercurochrome NF	280.00
Methyl Chloroformate	65.00

Product	Rs./kg.
Methyl Dopa	2000.00
Metronidazole IP	450.00
Morpholine	120.00
Niacinamide	310.00
Nifedipine	1100.00
Nitrofurazole	280.00
Oxyphenbutazone	585.00
Paracetamol	160.00
Pectin IP	480.00
Pepsin 1:3000	300.00
Phenbarbitone	510.00
Pheniramine Maleate	925.00
Phenyl Butazone USP	550.00
Piperazine Citrate	85.00
Potato Starch	65.00
Propranolol HCl	850.00
Saccharine Sodium	230.00
Salbutamol Sulphate	7600.00
Sodium Iodide	385.00
Sodium Methoxide	96.00
Sorbitol Powder	115.00
Sorbitol USP	13.00
Sulphacetamide	300.00
Sulphamethoxazole	285.00
Thiacetazone	235
Tinidazole	330.00
Theophylline Anh.	400.00
Trimethoprim IP	1090.00
Vitamin B6 Hydrochloride	1400.00
Vitamin B2 5-Phosphate	4300.00
Vitamin C Plain	285.00
Vitamin C Coated	290.00
Vitamin K3 W/S	675.00

POTASSIUM NITRATE

BARIUM CHLORIDE BARIUM NITRATE

BARIUM CARBONATE BARIUM SULPHATE

STRONTIUM SALTS D.M.A.

CONTACT:

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Phone: 325502/329618; Resi: 6460063
Gram: BAKHSHISH

Delhi Market

DELHI: MAY 11, (NNS) Sodium nitrite jumped up sharply from Rs. 1,125/1,225 to Rs. 1,600/1,800 per 50 kg in the Delhi chemicals market during the week under review, due to acute shortage or stock coupled with increased demand from stockists and bulk consumers, reports NNS. In Bombay it was quoted at Rs. 1,900 instead of Rs. 1,300 per 50 kg during the week. Hydrogen peroxide shot up again by Rs. 4/5 at Rs. 34/35 per kg on account of fall in fresh arrivals and spurt in demand from Bombay. In Bombay hydrogen peroxide rose from Rs. 33 to Rs. 36 per kg. Demand was also reported to be good from textile units. As a result of higher prices quoted by the manufacturers, sodium sulphate Gwalior Rayon hardened by Rs. 50 at Rs. 3,450 per tonne. Bleaching powder KCI, Modi and Shriram and Vikram brand were quoted at Rs. 90, Rs. 92, Rs. 101 and Rs. 91 per 25 kg respectively.

In the wake of fall in arrivals from Modi company and keen demand from consumers, caustic soda flakes moved up by Rs. 10 at Rs. 590 per 50 kg. On account of reduced arrivals from U.P. coupled with shortage of stock and brisk demand from consumers, menthol flake medium and bold jumped up by Rs. 15/30 at Rs. 345, Rs. 410 and Rs. 445 per kg respectively. DMO, mentha oil ruled quiet at Rs. 100.

Tartaric acid France looked up by Rs. 2 at Rs. 336 per kg in view of increased stocking tendency, while Swastic brand tartaric acid ruled quiet at Rs. 210 per kg. Citric acid Chinese and Bombay Dyeing jumped up by Rs. 30/50 at Rs. 1,950/2,500 followed by lower advices from Bombay. Sufolite slipped by Rs. 2 at Rs. 56 on withdrawal of demand. In the absence of demand from plastic and paint units coupled with increased offerings by stockists, titanium dioxide K-brand and TTK tumbled down by Rs. 3 each at Rs. 62 and Rs. 64 per kg respectively. Phosphoric acid suffered a fall of Rs. 100 at Rs. 1,500 per 50 kg in the wake of better supply. Trisodium phosphate drifted lower by Rs. 5 at Rs. 620, while mercury remained firm at Rs. 11,500 per flask due to shortage of stock. Prices of dyes and colours ruled quiet at their previous week levels.

(DELHI MARKET RATES AS ON MAY 11, 1990)

Ammonia Bicarb (Per 25 Kg.)	145.00
Mercury (Per flask)	11,500.00
Soda ash (Per bag)	360/380.00
Ammonium Chloride (50 Kg.)	110/180.00
Caustic soda flakes (50 Kg.)	590.00
Citric acid (Per 50 Kg.)	1,950/2,500.00
Stable Bleaching Powder Shriram (Per 25 Kg.)	101.00
Stable Bleaching Powder KCI (Per 25 Kg.)	90.00
Stable Bleaching Powder Maruti (Per 25 Kg.)	91.00
Stable Bleaching Powder Modi (Per 25 Kg.)	92.00
Sodium Bicarbonate (50 Kg.)	315/325.00
Sodium Hydrosulphite (Per Kg.)	37.00/39.50
Rangolite (Per Kg.)	83.00
Tartaric acid France (Per Kg.)	332.00
Sufolite (Per Kg.)	56.00
Chatkolite (Per Kg.)	48.00
DMO (per Kg.)	100.00
Boric acid Technical (Per 50 Kg.)	1,400.00
Paraffin Wax (Per 50 Kg.)	940.00
Slack wax (Per metric tonne)	9,000.00
Tartaric Acid (Swastik Per Kg.)	210.00
Borax Granular (Per 50 Kg.)	825.00
Borax Crystal (Per 50 Kg.)	950.00
Sodium Nitrite (Per 50 Kg.)	1,600/1,800.00
Sodium Nitrate (Per 50 Kg.)	440.00
Camphor Thal (Per Kg.)	103.00
Camphor Powder (Per Kg.)	94.00
Menthol Bold (Per Kg.)	445.00
Menthol Medium (Per Kg.)	410.00
Menthol Flake (Per Kg.)	345.00
Menthal Oil (Per Kg.)	225/245.00
Glycerine (Per Kg.)	55/58.00
Sodium Silicate (Per quintal)	300/400.00
Hexamine (Per Kg.)	34.00
Acetic Acid Glacial (Per Kg.)	15.00
Copper Sulphate (Per quintal)	2,300/2,600
Formic Acid (Per Kg.)	24.00
Formaldehyde (Per Kg.)	8.50
Hydrogen Peroxide (Per Kg.)	27.50/28.50
Calcium Carbonate (Per Tonne)	2,500/5,500
Acid Slurry Soft (Per Kg.)	28.00
Acid Slurry Hard (Per Kg.)	38.00
Phosphoric Acid (Per 50 Kg.)	1,500.00
Potassium Nitrate (Per quintal)	900/1,200.00
Potassium Permanganate (Per 50 Kg.)	2,600/3,000.00
Sodium Bichromate (Per 50 Kg.)	1,575/1,600.00
Trisodium Phosphate (50 Kg.)	625.00
Titanium Dioxide Anatase T.T.P. (Per Kg.)	72.00
Titanium Dioxide RC-822 (Per Kg.)	92.00
Titanium Dioxide K-Brand (Per Kg.)	67.00
Titanium Dioxide RCR-2 (Per Kg.)	N.A.
Zinc Oxide (Per Kg.)	44.00/50.00
Phenol Carbolic Acid (Per Kg.)	37.00
Carbon Tetrachloride (Per Kg.)	24.75
Chloroform (Per Kg.)	28.00
Sodium Sulphate (Per metric tonne)	3,400/3,700.00
Naphthalene Balls (Per 50 Kg.)	1,400.00
DYES & COLOURS	**(Per Kg.)**
Naphthol AS	175/201.65
Naphthol ASG	180/295.20
Naphthol ASBS	210/248.45
Naphthol ASTR	275/360.45
Naphthol ASOL	210/238.60
Naphthol ASBO	195/260.75
DIRECT DYES	**(Per Kg.)**
Black E. Conc.	120/176.90
Diazo Black B.T.	105/147.55
Green B	90/140.55
Blue 2-B	60/101.40
Blue 2-B 225% (JNR)	125.00
Sky Blue FB	160/235.05
Basic Auramine	55/110.00
Basic Rhodamine	300/425.00
Basic Methylene Blue	100/180.00
Basic Violet	165/210.00
Basic Malachite Green	175.00
Acid Orange	75/111.20
Congo Red H/C	75/120.95

Madras Market

Incessant rains during the week affected normal trading and movement of materials. However, there is no significant change in the rates on pattern of business. Supply position of materials continue to be easier and the present trend is expected to continue.

The threat of any increase in powercut is over due to good rainfall in the catchment areas and commissioning of additional thermal power plants by Tamil Nadu Government in the recent weeks. Caustic soda prices is expected to be firm for sometime.

(MADRAS MARKET RATES AS ON MAY 12, 1990)

Acetic Acid Glacial (per kg)	14.50
Aluminium Sulphate Iron free (per MT)	3,500.00
Ammonium Bicarbonate (per 25 kgs)	150.00
Ammonium Chloride (per MT)	3,000.00
Acid Slurry (per kg)	31.00
Barium Carbonate (per kg)	9.00
Barium Chloride (per kg)	8.50
Boric Acid Technical (per kg)	26.00
Bleaching Powder (per 50 kgs)	220.00
Borax (per 50 kgs)	785.00
Caustic Soda Flakes – Mettur Chemicals (per MT)	12,000.00
Caustic Soda Flakes – Andhra Sugars (per MT)	12,000.00
Calcium Chloride 70% Solid (per MT)	3,500.00
Calcium Chloride Anhydrous (per MT)	5,750.00
Calcium Carbonate (Activated) (per MT)	6,500.00
Calcium Carbonate (Precipitated) (per MT)	5,500.00
Citric Acid (per kg)	48.00
Copper Sulphate (per kg)	24.00
Cresylic Acid 98-99% (per kg)	130.00
Pure Para Cresol 96% (per kg)	87.00
Meta Para Cresol 42% (per kg)	50.00
Formic Acid (per kg)	26.00
Formaldehyde (per kg)	8.00
Glue Flakes (per kg)	15.00
Glycerine I.W. (per kg)	49.50
Hydrosulphite of Soda. (TCPL) (per kg)	36.00
Hydrosulphite of Soda (IDI) (per kg)	40.00
Hydrosulphite of Soda (BASF) (per kg)	40.00
Hexamine (per kg)	31.00
Hyflosupercell (per kg)	19.00
Hydrogen Peroxide (per kg)	31.50
Litharge (per kg)	40.00
Lead Acetate (per kg)	38.00
Magnesium Carbonate (per kg)	18.00
Magnesium Chloride (per kg)	3.50
Maleic Anhydride (per kg)	40.00
Menthol Crystals (per kg)	350.00
Oxalic Acid (per kg)	17.00
Paraffin Wax (per kg)	17.00
Potassium Bichromate (per kg)	36.00
Phosphoric Acid (per kg)	28.00
Polyvinyl Alcohol Powder (per kg)	120.00
Pentaerythritol (per kg)	52.00
Phthalic Anhydride (per kg)	30.00
Soda Ash (TAC) (per 75 kgs)	420.00
Soda Ash (TATA) (per 75 kgs)	420.00
Sodium Bicarbonate (TATA) (per 50 kgs)	385.00
Sodium Silicate (per MT)	3,500.00
Sodium Bichromate (per kg)	28.00
Sodium Nitrate (per kg)	8.00
Sodium Nitrite (per kg)	15.00
Sodium Sulphide Flakes (per kg)	14.00
Sodium Bisulphite (per kg)	8.00
Sodium Alginate (per kg)	275.00
Sodium Acetate (per kg)	7.50
Sodium Sulphate (Anhydrous) (per kg)	3.60
Titanium Dioxide (Anatase) (per kg)	65.00
Titanium Dioxide (Rutile) (per kg)	85.00
Trisodium Phosphate (per kg)	13.50
Urea (Technical) (per kg)	3.00
Zinc Oxide (per kg)	50.00
Zinc Chloride Powder (per kg)	12.50
Zinc Sulphate (per kg)	8.00

SOLVENTS

Acetone -- HOCL (per kg)	18.00
Butanol (per kg)	35.00
Butyl Acetate (per kg)	36.00
Benzene (per lit)	14.00
Cellosolve (per kg)	60.00
Carbon Tetra Chloride (per kg)	21.00
Chloroform (per kg)	29.00
Diacetone Alcohol (per kg)	30.00
Diethylene Glycol (per kg)	30.00
Dichloroethane (per kg)	18.00
Di-octyl Phthalate (per kg)	46.00
Di-N-butyl Phthalate (per kg)	46.00
Ethyl Acetate (per kg)	20.00
Isopropyl Alcohol (per kg)	23.75
Methanol (per kg)	10.00
Methylene Chloride (per kg)	21.00
Methyl Ethyl Ketone (per kg)	34.00
Methyl Isobutyl Ketone (per kg)	41.25
Phenol (per kg)	38.00
Sorbitol (per kg)	15.00
Triethanolamine (per kg)	90.00
Trichloroethylene (per kg)	26.00
1-1 1 Trichloroethane (per kg)	29.00
Turpentine (per lit)	16.00
Toluene (per lit)	13.00
Xylene (per lit)	17.00

Shipping News

VESSELS DUE IN BOMBAY FOR EXPORT LOADING

Due Date (1)	Steamer's Name & Flag (2)	Agents (3)	Will load for (4)	Approx. sailing dt. (5)
19/5	Transport Schelde (Voy-703)	Merzario/	Jeddah; Hodeidah; P. Sudan; Ravenna; Ancona; Piraeus; Venice; Trieste. (Carting at M.O.D. No. 1).	24/5
		Seaspeed/	Tilbury; London; Felixstowe; Manchester; Liverpool; Avonmouth; Le Havre; Rotterdam; Hamburg; Antwerp; Bremerhaven and Scandinavian ports. (Carting at M-178 Cotton Depot).	
		L. Triest/	Jeddah; Trieste; Venice; Ravenna; Rijeka; Naples. (Carting at M-171/173 Cotton Depot).	
		Killick/	Jeddah; Felixstowe; London; Liverpool; Manchester; Bristol; Avonmouth; Leeds; Glasgow; Tilbury; Birmingham; Dublin; Belfast; Rotterdam; Hamburg; Le Havre; Antwerp; Bremen; Bremerhaven; Fos; Valencia; Marseilles; Barcelona & Scandinavian ports. (Carting at E-Shed Grain Depot).	
		S.W. & Co./ Trident/ P&O	Tilbury; London; Felixstowe; Avonmouth; Manchester; Liverpool; Glasgow; Leeds; Birmingham; Dublin; Belfast; Bristol; Marseilles; Genoa; Barcelona; Le Havre; Antwerp; Rotterdam; Hamburg; Bremerhaven; Copenhagen; Oslo; Helsinki; Malmao; Gothenburg; Stockholm; Aarhus; Alborg. (Carting at Timber Pond No. 4 for S.W. & Co., Trident and P&O).	
		Patvolk	Genoa; Marseilles; Antwerp; Le Havre; Rotterdam; Hamburg; Cristobal; Papeete. (Cartng at Hay Bunder No. 4).	
16/5	Arab Mazin-(Sau)	Depe	Jeddah, Aden. (Carting at 5-VD).	25/5
21/5	CMB Marque (Nhava Sheva)	C.M.B.	Djibouti; Port Sudan; Jeddah; La Speia; Valencia; Genoa; Barcelona; Marseilles; Tunis; Casablanca; Tangier; Alexandria; Piraeus; Mersin; Limassol; Felixstowe; London; Liverpool; Manchester; Birmingham; Avonmouth; Dublin and all inland destinations in U.K.; Antwerp; Rotterdam; Hamburg; Bremen; Leixoes; Lisbon; Copenhagen; Oslo; Gothenburg; Stockholm; Malmao; Aarhus; Helsinki. (Carting at Kalamboli)	23/5
20/5	Bharatendu	S.C.I.	Odessa.	31/5
18/5	Olandia	Samrat/ Hindustan/ Merzario	Felixstowe; Hamburg; Rotterdam; Also London; Liverpool; Leixoes; Lisbon; Manchester; Avonmouth; Wembly; Birmingham; Liecester; Le Havre; Bremen; Amsterdam; Antwerp; Copenhagen; Leeds; Aarhus; Gothenburg; Oslo; Helsinki; Stockholm; Belfast & all destinations in U.K., Benelux; Germany; Italy; France; Switzerland and Austria. (Carting at M.O.D. No. 1 for Merzario).	24/5
19/5	Ever Bridge (V-030) (Pan)	Greenways	Hamburg; Felixstowe; Rotterdam; Antwerp; Le Havre; London; Liverpool; Leixoes; Lisbon; Manchester; Avonmouth; Wembly; Birmingham; Leeds; Leicester; Amsterdam; Bremen; Copenhagen; Aarhus; Gothenburg; Oslo; Stockholm; Helsinki; Belfast and all destinations in U.K., Germany; Switzerland and Austria. (Carting at G/H Cotton Depot).	24/5
20/5	Kapitan Kud (Rus)	Transocean	Odessa; Illyichevsk; Havana (Cuba); Genoa; Trieste; Piraeus; Marseilles; Barcelona; Varna; Bourgas. (Carting at Kalamboli).	24/5
26/5	Robert E Lee	M.S.P.L.	Aqaba; Assab; P. Sues; (Alexandria). (Carting at P/Q-PD).	26/5
20/5	Kapitan Medivetskiy	Sai Ship	Mogadiscio; Mombasa; Dar Es Salaam.	26/5
21/5	CMB Marque (Nhava Sheva)	C.M.B.	Dar Es Salaam; Mombasa (Direct); Nacala; Tanga; Kampala; Blantyre; Lusaka; Ndoia; Matwara; Lilongwe and all inland destinations in East Africa. (Carting at Kalamboli).	23/5
18/5	Sambrine	S.D.S.	Port Louis; Tamataveg Re Union	25/5
17/5	Eagle Star (V-34)	F.F.C. Co.	Penang; P. Kelang; Singapore; Bangkok; Jakarta; (T. Priok); Hongkong; Manila; Busan; Keelung; Kaohsiung; Kobe; Yokohama; Nagoya; Osaka; Tokyo; Tsingtao; Dairen; Quangzhou; Whampoa; Shanghai; Hsingkang. (Carting at Timber Pond No. 1).	23/5
22/5	Nortween Merchant	Delta	Far East Ports. (Brekbulk only)	28/5

(1)	(2)	(3)	(4)	(5)
19/5	Ocean Sincerity (V-23A/B) (Lib)	O.S.A./	P. Kelang; Singapore; Kaohsiung; Hongkong; Bangkok; Kobe; Yokohama; Nagoya; Moji; Osaka; Busan; Tokyo; Simizu; Keelung; Tsingtao; Quindao; Ziangang; Shanghai. (Carting at M-178/180 C.D.).	25/5
		M.S.P.L.	Singapore; Bangkok; P. Kelang; Penang; Jakarta; Manila. (Carting at E-Grain Depot).	
19/5	Ever Bridge (V-030) (Pan)	Greenways	Singapore; Penang; Port Kelang; Bangkok; Djakarta; Surabaya; Manila; Cebu; Kaohsiung; Keelung; Osaka; Yokohama; Kobe; Shimizu; Moji; Nagoya; Busan; Hongkong. (Carting at G/H Cotton Depot).	24/5
24/5	Mahsuri	Killick/ P&O/I.M.E.	Singapore. (Carting at H.B. No. 4 for Killick) (Carting at T.P. No. 4 for P&O) (Carting at W.B. No. 3 for I.M.E.).	27/5
26/5	Robert E Lee	M.S.P.L.	Singapore. (Carting at P/Q-PD).	26/5
19/5	Ocean Sincerity	O.S.A.	Sydney; Melbourne; Adelaide; Brisbane; Fremantle; Auckland; Wellington; Lyttelton; P. Chalmers. (Carting at M-178/180 Cotton Depot)	25/5
24/5	Mahsuri V-0574)(Sing)	Killick/ P&O/	Melbourne; Sydney; Brisbane; Adelaide;Fremantle; P. Hobart; Devon P. Launcheston; Burnie; P. Chalmers; Lyttelton; Christchurch; Dunedin; New Plymouth; Auckland; Wellington; Napier. also Western Samoa; Papua; New Guinea; Solomon Island; American Samoa; Tonga; New Calidonia; Rabaul; P. Villa. (Carting at H.B. No. 4 for Killick). (Carting at T.P. No. 4 for P&O).	27/5
		I.M.E.	Sydney; Melbourne; Adelaide; Fremantle; Brisbane; Auckland; Wellington; Lyttelton. (Carting at Wadi Bunder No. 3).	
17/5	Eagle Star (V-34)	F.F.C. Co.	Dubai; Sharjah; Abu Dhabi; Doha; Muscat; Dammam; Riyadh; Bahrain; Kuwait. (Carting at Timber Pond No. 1).	23/5
19/5	Transport Schelde (Voy-703)	Penguin/	Dubai; Abu Dhabi; Sharjah; Doha; Muscat; Jebel Ali; Kuwait; Bahrain; (Carting at H.B. No. 4).	24/5
		Merzario/	Dubai; Sharjah; Abu Dhabi; Muscat; Doha; Dammam; Kuwait; Bahrain. (Carting at M.O.D. No. 1).	
		L. Triest/	Dubai; Dammam; Riyadh; Muscat; Abu Dhabi; Doha; Kuwait; Bahrain. (Carting at M-171/173 Cotton Depot).	
		Killick/	Dubai; Dammam; Riyadh; Bahrain; Kuwait. (Carting at E-Shed Grain Depot)	
		O.S.A./	Dubai; Abu Dhabi; Bahrain; Doha; Muscat; Kuwait; Dammam. (Carting at M-178/180 Cotton Depot).	
		Seaspeed/	Dubai; Dammam; Bahrain; Kuwait; Doha. (Carting at M-178 Cotton Depot).	
		Kanika/	Dubai; Abu Dhabi; Sharjah; Muscat; Kuwait; Bahrain. (Carting at T.P. No. 3).	
		Parekh	Muscat; Dubai; Sharjah; Abu Dhabi; Basrah; Baghdad; Mosul. (Carting at Timber Pond No. 3).	
15/5	A.S. Altincan	U.L.A.	Mina Qaboos; Dubai; Kuwait.	25/5
18/5	Lanka Abhaya	Seahorse	Dubai; Khorfakkan; Sharjah; Muscat; Dammam; Riyadh; Kuwait. (Carting at M.O.D. No. 3).	25/5
19/5	Rossana (V-43W)	Mackintosh	Muscat; Dubai. (Carting at C-PD).	26/5
21/5	CMB Marque (Nhava Sheva)	C.M.B.	Dubai; Abu Dhabi; Bahrain; Kuwait; Dammam; Doha. (Carting at Kalamboli).	23/5
17/5	Eagle Star (V-34)	F.F.C. Co.	Los Angeles (Harbour); Lognbeach; San Francisco; Oakland; Seattle; Vancouver (B.C.); Portland; New York; Boston; Norfolk; Baltimore; Charleston; Savannah; Miami; New Orleans; Houston; Montreal; Toronto; Fortworth; Chicago; Nashville; Atlanta; Philadelphia; Milwaukee; Kansas City; Phoenix; Guam; Dallas; Cleveland; St. Louis; Cincinnati; Denver; Louisville; Memphis; Wilminghton (B.C.); San Diego; Minneapolis; Indianapolis and Central American ports; Honolulu. (Carting at Timber Pond No. 1).	23/5
15/5	Hreljin	Oceanic	New York; Baltimore; Philadelphia; Chicago; Boston; Norfolk; Atlanta; Charleston; Savannah; Miami; Houston and other inland destinations in U.S. East Coast and South American Ports. (Carting at Wadi Bunder No. 3).	24/5
19/5	Transport Schelde (Voy-703)	Patvolk/P&O/ S.W. & Co./ Trident/ Seaspeed	S. American ports. (Carting at T.P. No. 4 for P&O, S.W. & Co. and Trident) (Carting at Hay Bunder No. 4 for Patvolk) New York; Norfolk; Savannah; Baltimore; Boston; Charleston; Houston. New York; Baltimore; Norfolk, Savannah; Charleston; Houston; and S. American Ports. (Carting at M-178 Cotton depot).	24/5

(1)	(2)	(3)	(4)	(5)
21/5	CMB Marque (Nhava Sheva)	C.M.B.	Norfolk; New York; Baltimore; Philadelphia; Charleston; Savannah; Houston; Miami; New Orleans; Via Antwerp; Montreal; Toronto; Halifax. (Carting at Kalamboli).	23/5
19/5	Ocean Sincerity (V-23A/B)	O.S.A.	New York; Baltimore; Philadelphia; Houston; Boston; Chicago; Dallas; Atlanta; Savannah; Norfolk; Charleston; Los Angeles; San Francisco; Oakland; Seattle; Vancouver; Toronto; Montreal; Portland; Tacoma and S. American & West Indies Ports. (Carting at M-178/180 C.D.).	25/5
19/5	Ever Bridge (Voy-030)	Greenways	New York; Newark; Baltimore; Charleston; New Orleans; Houston; Boston; Providence (RI); Philadelphia; Norfolk; Savannah; Jacksonville; Wilmington; Miami; Montreal; Toronto; Bermuda; Los Angeles; Longbeach; San Francisco; Oakland; San Diego; Stockton; Richmond; Almeida; Redwood City; Sacramento; Seattle; Portland; Vancouver (B.C.); Tacoma; Longview; Chicago; Dallas; Various inland destinations and Caribbean ports. (Carting at G/H Cotton Depot).	24/5
24/5	Mahsuri	Killick	S. American Ports. (Carting at H.B. No. 4).	27/5
26/5	Robert E Lee (Ame)	M.S.P.L.	Philadelphia; Baltimore; Norfolk; New Orleans; Houston; Savannah; New York. (Carting at P/Q-PD).	26/5
19/5	Transport Schelde	Patvolk/P&O/ S.W. & Co.	West African Ports. (Carting at T.P. No. 4 for P&O and S.W.&Co.) (Carting at Hay Bunder No. 4 for Patvolk)	24/5
		Seaspeed	West African ports. (Carting at M-178 Cotton Depot).	
21/5	CMB Marque (Nhava Sheva)	C.M.B.	Lagos; Abidjan; Lome; Douala; Matadi; Port Gentil; Pointe Noire; Nouakchott; Cotonou; Dakar; Luanda; Monrovia; Tema via Antwerp. (Carting at Kalamboli).	23/5
18/5	Olandia	Merzario	Dakar; Abidjan; Monrovia; Lome; Douala; P. Noire; Matadi; Libreville; Cotnou; P. Gentil; Lagos; P. Harcourt; Warri; Freetown; Conakry; Luanda; Nouakchott; Guinea; Blassa. (Carting at M.O.D. No. 1).	24/5

VESSELS DUE FOR IMPORT DISCHARGE

Due Date	Steamer's Name	Agents	From
25/5	Fagarat	South India	Rum./Turkey
24/5	Ibn Al Moataz	Transworld	S. America
28/5	Jala Godavari	I.S.S. Co.	U.K. Cont.
30/5	Medipas Star	L. Triest/Hindustan	U.K. Cont. & Med.
24/5	Mahsuri (V-0574)	Killick/P&O/IME	Aust./Nz. & Gulf
26/5	Perla	Sai Ship	S. America
28/5	Tulsidas	S.C.I.	Australia
23/5	Vishva Nandini	S.C.I.	E. Africa

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Materials Imported

MATERIALS IMPORTED BOMBAY

9.3.90

(Continued from previous issue)

PVC: From Brazil: Ashish Chemo Plast Equipment, 190 MTs., Rs. 22,12,458; From Japan: PDI Chemical Ltd., 17,000 Kgs., Rs. 6,42,400; Shriram Vinyl Chem. Inds., 6 MTs., Rs. 3,23,768; Triveni Chemicals Ltd., 34,000 Kgs., Rs. 11,68,493; Vam Organic Chemicals Ltd., 17 MTs., Rs. 6,86,800.

PVC RESIN: From USA: Caprihans India Ltd., 247.45 MTs., Rs. 29,94,156; From Spain: Dunlop India Ltd., 26,000 Kgs., Rs. 5,18,496; From Mexico: Gujarat State Corpn Ltd., 49.95 MTs., Rs. 5,85,777; Jasch Plastics, 52 MTs., Rs. 8,79,534; From Brazil: K.B. Trading Co., 304 MTs., Rs. 35,14,201; From Romania: Kundalia Industries, 1,00,000 Kgs., Rs. 11,40,134; Maniyar Pkg. Pvt. Ltd., 100 MTs., Rs. 11,42,892; From Mexico: Movilex Plastics Ltd., 49.5 MTs., Rs. 5,65,619; From Taiwan: Northern (I) Leather Cloth Mfg. Co. P. Ltd., 50 MTs., Rs. 9,18,822; From Mexico: Star Plastics, 34 MTs., Rs. 4,12,585.

POLYETYLENE: From Taiwan: Pearl Polymers Ltd., 54 MTs., Rs. 9,28,340.

POLYCARBONATE: From FRG: Sumeet Machines P. Ltd., 5,250 Kgs., Rs. 3,15,894.

POLYPROPYLENE: From USA: Anant Plastics Pvt. Ltd., 52.5 MTs., Rs. 6,94,967; From France: Area Ltd., 6,000 Kgs., Rs. 5,77,634; From Yugoslavia: Arun Fats & Oil Cakes, 15.5 MTs., Rs. 2,35,219; From USA: Atul Enterprises, 15,000 Kgs., Rs. 1,83,090; From Portugal: Bajaj Plastics Ltd., 13.1 MTs., Rs. 1,85,439; From USA: Dinshaw Iron Works, 15,000 Kgs., Rs. 1,83,090; From Korea: Gilt Pack Ltd., 50 MTs., Rs. 7,33,252; From USA: Kosmo Packers, 17.5 MTs., Rs. 2,33,160; From Yugoslavia: National Celluloid Products, 15.5 MTs., Rs. 2,51,675; From USA: Press Well Industries, 15,000 Kgs., Rs. 1,83,090; From UK: R.S. Industries, 32 MTs., Rs. 14,27,591; From Yugoslavia: Sapana Polyweave Private Ltd., 15.5 MTs., Rs. 2,50,480; Shree Arvind Plastics, 15.5 MTs., Rs. 2,51,675; From Japan: The Supreme Industries Limited, 54.001 MTs., Rs. 13,08,759; From Yugoslavia: Wimco Pen Company, 93 MTs., Rs. 15,08,400.

POLYVINYL PYRROLIDONE: From FRG: Burroughs Wellcome (I) Ltd., 700 Kgs., Rs. 1,70,020; Mangalya Trading Investment, 500 Kgs., Rs. 1,21,443.

POLYSTYRENE: From Korea: Universal Polychem, 204 MTs., Rs. 28,40,722.

SODIUM 2 ETHYL HEXANOATE: From Italy: Pharmachem, 1020 Kgs., Rs. 68,558.

TITANIUM DIOXIDE: From Japan: Dhanania Rubber Ltd., 5,000 Kgs., Rs. 1,20,340: From USA: Poly Processors, 6,804 Kgs., Rs. 3,27,519.

TOLUENE DIISOCYANATE DESMODUR T 80: From Belgium: Key Foam Limited, 5,500 Kgs., Rs. 2,12,744.

TRIETHYLENE GLYCOL: From Japan: Oil and Natural Gas Commission, 97.2 MTs., Rs. 26,85,533.

PLASTIC MATERIALS IMPORTED BOMBAY

9.3.90

HDPE: From Hungary: Asian Plastics, 10 MTs., Rs. 1,16,541; From Japan: Balaji Enterprises, 16 MTs., Rs. 2,22,802; From Saudi Arabia: Chemofine Corporation, 49.5 MTs., Rs. 6,15,600; From USA: Climax Pipes Pvt. Ltd., 68.75 MTs., Rs. 7,20,968; From Saudi Arabia: Indexin (Huf)

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17.15 MTs., Rs. 2,18,177; From Saudi Arabia: K. Raheja Mercantile Corporation, 51.450 MTs., Rs. 7,34,136; Gem Properties Private Limited, 17 MTs., Rs. 2,11,855; From Yugoslavia: Grover Overseas Private Limited, 90 MTs., Rs. 14,90,733; From Saudi Arabia: Silver Plastochem Private Limited, 17.15 MTs., Rs. 2,46,186; Vallabh Polypac Industries Private Limited, 17.15 MTs., Rs. 2,27,022; From USA: Vishal Plastic Industries, 82.5 MTs., Rs. 10,66,935.

LLDPE: From Saudi Arabia: The Bharat Vijay Mills Ltd., 165 MTs., Rs. 24,98,362; From Netherlands: Futuristic Packaging India Limited, 15 MTs., Rs. 2,14,034; From Saudi Arabia: Unillas India Limited, 99 MTs., Rs. 13,19,017.

POLYPROPYLENE: From Yugoslavia: Arun Fats & Oil Cakes, 46.5 MTs., Rs. 7,05,657; From Japan: The Supreme Inds. Ltd., 54.1 MTs., Rs. 13,08,759.

DRUG MATERIALS IMPORTED BOMBAY

9.3.90

AMPROLIUM HCl USP: From USA: Merind Ltd., 2,500 Kgs., Rs. 11,51,830.

D-ALPHA PHENYL GLYCINE BASE: From Taiwan: Armour Chemicals Ltd., 9,000 Kgs., Rs. 23,59,532.

HYDROXY PROPYL METHYL CELLULOSE USP: From Japan: SIL Pharmaceuticals P. Ltd., 50 Kgs., Rs. 18,122.

2-HYDROXYETHYL AMINO 3 PROPIONYL AMINOBENZYL DOPA: From Switzerland: Sandoz India Ltd., 3,100 Kgs., Rs. 11,22,076.

MAGNESIUM OXIDE LIGHT USP: From Israel: The Anglofrench Drug Co. Ltd., 1,005 Kgs., Rs. 33,397.

D(-) PARA HYDROXY PHENYL GLYCINE METHYL POTASSIUM SALT: From Singapore: Pharmachem, 1,000 Kgs., Rs. 3,69,230.

DL-PHENYLPROPANOLAMINE HCl BP USP: From Japan: SPA Pharmaceuticals P. Ltd., 200 Kgs., Rs. 89,396.

PYRIDOXINE HYDROCHLORIDE BP 88 USP: From Yugoslavia: Krishnalal Hiralal, 250 Kgs., Rs. 1,46,128.

VITAMIN B6 IP/BP 88/USP 21 PYRIDOXINE HCl: From Yugoslavia: Medi Pharma Drugs House, 175 Kgs., Rs. 1,02,290.

MATERIALS EXPORTED BOMBAY

(From 18.1.90 to 23.1.90)

4 ACETYL AMINO 2 AMINO ANISOLE: To Felixstowe: Amritlal Chemaux Ltd., 2,000 Kgs., Rs. 4,66,908

ALKYD RESIN: To Jeddah: H.P. International, 1,300 Kgs., Rs. 63,770.

ALUMINIUM CHLORIDE: To Milan: Kline Chemicals Pvt. Ltd., 18,150 Kgs., Rs. 2,82,735.

AROMATIC CHEMICALS: To Dubai: S.H. Kelkar & Co., 6,720 Kgs., Rs. 9,35,000.

BETA CARBOETHOXY PROPIONYL CHLORIDE: To Baltimore: Abbott Laboratories Ltd., 1,080 Kgs., Rs. 5,93,958.

BETA CHLORO ETHYL AMINE HYDROCHLORIDE: To New York: Amaranth Inds., 2,666 Kgs., Rs. 1,15,000.

BETA PHENYLENE DIAMINE: To New York: Vivid Exports, 1,290 Kgs., Rs. 1,28,662.

DANE SALT: To Odessa: Armour Chemicals Ltd., 15,000 Kgs., Rs. 34,42,500.

DIMETHOXY DIBENZANTHRONE: To Felixstowe: Amritlal Chemaux Limited, 2,000 Kgs., Rs. 12,31,678.

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GAMMA ACID: To Barcelona: Jeevan Products, 5,600 Kgs., Rs. 75,764.

GAMMA ACID DRY: To New York: Atul Products Ltd., 4,410 Kgs., Rs. 5,89,759.

H-ACID: To New York: Vishnu Chem Intermediates, 15,297.84 Kgs., Rs. 12,95,472; Zenith Ltd., 26,450 Kgs., Rs. 20,22,906.

HEXA CHLOROETHANE: To Dubai: Scottish Chemical Inds., 20,000 Kgs., Rs. 3,35,000.

1,2 HYDROXY STEARIC ACID: To Felixstowe: Jayant Oil Mills, 14 MTs., Rs. 3,47,574; To Venice: Jayant Oil Mills, 14 MTs., Rs. 3,47,574.

DICALCIUM PHOSPHATE: To Penang: Nayankumar & Co., 80,000 Kgs., Rs. 3,29,685.

LEAD ACETATE: To Mombassa: Liladhar P. Shah & Co., 1,000 Kgs., Rs. 65,000.

MANGANESE DIOXIDE: To Keelung: Indl. Chemical Agencies, 63,000 Kgs., Rs. 3,55,915.

METANILIC ACID: To New York: Sadhana Nitro Chem. Ltd., 36,000 Kgs., Rs. 17,37,670.

METHYL PARATHION: To Piraeus: Bayer India Ltd., 18,000 Kgs., Rs. 12,09,872.

METHYLENE CHLORIDE: To Singapore: Gujarat Alkalies & Chem. Ltd., 18,000 Kgs., Rs. 1,32,000.

METHYLENE CHLORIDE 99.9%: To Manila: Gujarat Alkalies & Chem. Ltd., 18,000 Kgs., Rs. 1,40,000; To Port Kelung: Gujarat Alkalies & Chem. Ltd., 18,000 Kgs., Rs. 1,35,000.

METRONIDAZOLE BENZOATE IP: To Hamburg: Manjarati Chemicals, 2,500 Kgs., Rs. 5,66,000.

MICROCRYSTALLINE CELLULOSE POWDER: To Toronto: Metro Exporters (I) Ltd., 1,050 Kgs., Rs. 45,856.

PENTAERYTHRITOL: To Mombassa: United Breweries Intl., 18,000 Kgs., Rs. 3,27,976.

PHTHALIC ANHYDRIDE: To Mombassa: United Breweries Intl., 36,000 Kgs., Rs. 3,99,361.

SODIUM CYANIDE TABLETS: To Guaira: Cyanide & Chemicals Co., 71,910 Kgs., Rs. 29,17,770.

SODIUM SULPHATE 99% PURE MIN.: To Bangkok: Grasim Inds. Ltd., 1,100 Kgs., Rs. 19,98,308.

SULFO TOBIAS ACID: To New York: Vivid Exports, 4,720 Kgs., Rs. 2,88,808.

SULPHONIC ACID: To New York: Vivid Exporters, 1,290 Kgs., Rs. 1,28,629.

THIONYL CHLORIDE: To Felixstowe: Transpek Inds. Ltd., 18,000 Kgs., Rs. 1,99,200.

VINYL SULPHONE ACETANILIDE: To New York: National Organic Chemical Ltd., 56,500 Kgs., Rs. 45,84,434; Vivid Exports, 5,350 Kgs., Rs. 4,20,163.

MATERIALS IMPORTED BOMBAY

14.3.90

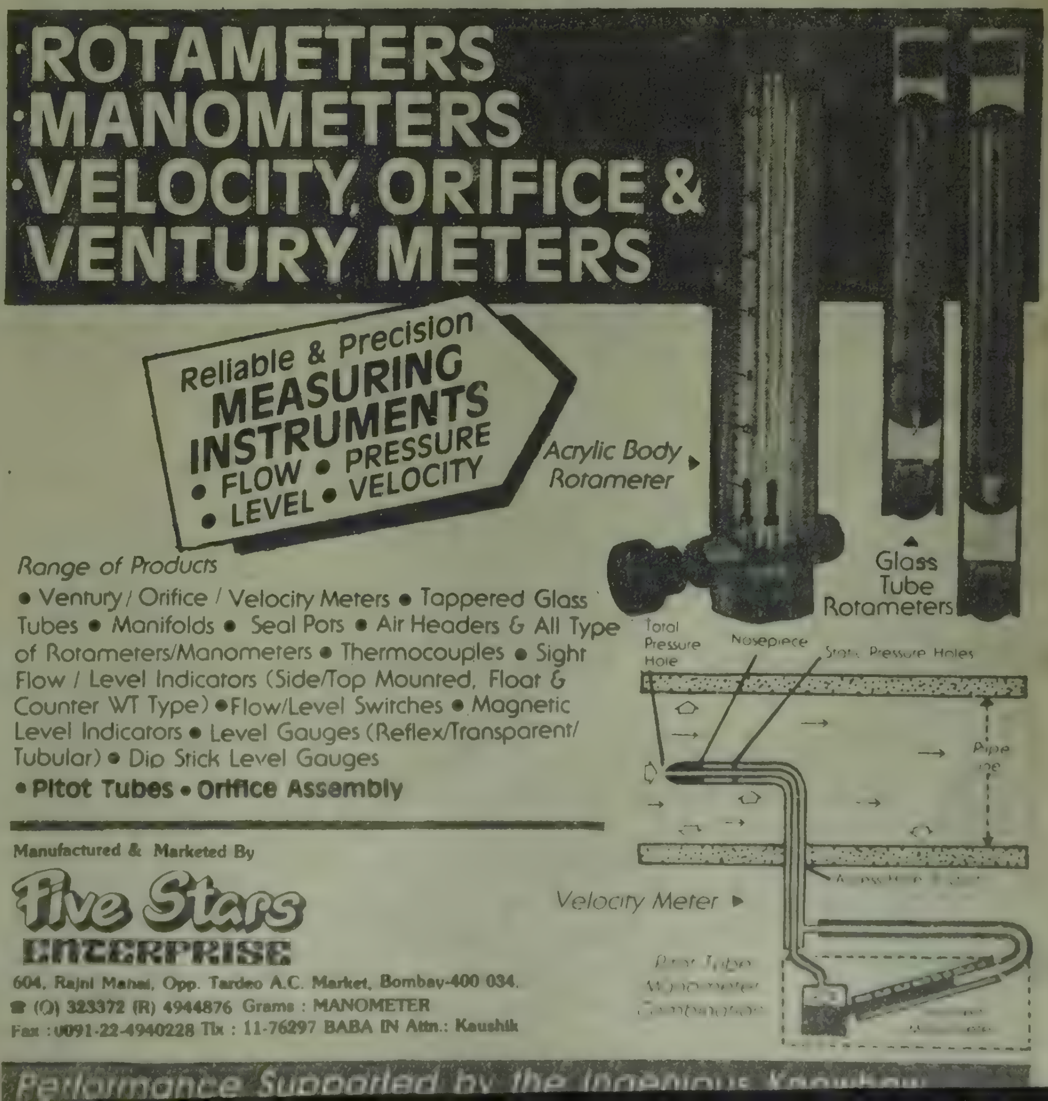
ALPHA PICOLINE: From Netherlands: Associated Chemical Inds., 2,200 MTs., Rs. 1,33,578.

4-AMINO BENZOIC ACID BENZYL ESTER: From Switzerland: Sandoz India Ltd., 1,386 Kgs., Rs. 8,000.

ANTIMONY TRIOXIDE: From Belgium: Cable Corpn. of India Ltd., 1,000 Kgs., Rs. 52,606.

BENZENE SULPHONYL CHLORIDE: From Japan: Colour Chem Ltd., 1,500 Kgs., Rs. 88,798.

CAPROLACTAM: From Netherlands: Century Enka Ltd., 252 MTs., Rs. 73,61,559.



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CITRIC ACID: From Singapore: Mack Chem Corporation, 20 MTs., Rs. 2,49,276.

CYANURIC CHLORIDE: From FRG: Jay Chemical Inds., 12,000 Kgs., Rs. 6,55,788.

DIETHYL SULPHATE: From Japan: Pidilite Industries Ltd., 5,060 Kgs., Rs. 1,28,224; From Japan: Henkel Chemicals India Ltd., 2,070 Kgs., Rs. 53,768.

DI ISOBUTYL KETONE: From Netherlands: Haryana Leather Chemicals Limited, 22,275 Kgs., Rs. 9,70,137.

1,4-DIOXANE: From Japan: Voltas Ltd., 1,000 Kgs., Rs. 22,355.

ETHYL HEXANOIC ACID: From FRG: Aman Enterprises, 7,021 Kgs., Rs. 1,31,432.

2-ETHYL HEXANOL 99%: From FRG: Indian Organic Chemicals Ltd., 4,00,013 Kgs., Rs. 43,46,149.

GUM RESIN: From Hong Kong: Ballarpur Industries Ltd., 99.9 MTs., Rs. 8,46,851.

METHYL DICHLORO ACETATE: From Japan: Metrox Fine Chemicals P. Ltd., 500 Kgs., Rs. 18,364.

NICKEL SULPHAMATE: From France: ITB Limited, 11,925 Kgs., 8,07,589.

NITRO AMINO AMYLPHENOL: From Japan: Indian Dyestuff Inds. Ltd., 1,210 Kgs., Rs. 6,98,337.

PHENYL XYLYL ETHANE: From Japan: Mohan Electrical Inds. Ltd., 5,000 Kgs., Rs. 1,50,425.

POLYCARBONATE: From Netherlands: Peico Electronics & Elect. Ltd., 2.5 MTs., Rs. 3,55,484.

POLYPROPYLENE: From USA: Paresh Plastics, 33.3 MTs., Rs. 4,08,626; The Supreme Inds. Ltd., 49.95 MTs., Rs. 6,07,493.

POLYSTYRENE: From Korea: Gujarat State Export Corpn. Ltd., 350 MTs., Rs. 55,13,723.

PROPIONIC ANHYDRIDE: From Japan: Dy-Mach Pharma, 1,080 Kgs., Rs. 48,375; Kiran Chemicals, 1,980 Kgs., Rs. 85,026.

PVC: From Brazil: National Organic Chemical Inds. Ltd., 500 Kgs., Rs. 57,35,960; From USA: Ajay Indl. Corpn., 87.5 MTs., Rs. 9,63,847.

PVC RESIN: From USA: Ajay Indl. Corpn., 87.5 MTs., Rs. 11,09,874; From Japan: Chloride Inds. Ltd., 42 MTs., Rs. 9,03,201; From Hungary: Kundalia Inds., 314.75 MTs., Rs. 33,80,211; From Mexico: Oswal Cable Products, 99 MTs., Rs. 11,26,153; Plaza Chemical Inds., 199.5 MTs., Rs. 23,74,268;

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PYRIDINE PURE: From Japan: Turbhe Chemicals P. Ltd., 5,070 Kgs., Rs. 3,36,441.

TITANIUM DIOXIDE: From UK: Inarco Ltd., 20,000 Kgs., Rs. 8,49,746.

4-TOLUIDINE 3-SULPHONIC ACID: From Japan: Colour Chem. Ltd., 4,000 Kgs., Rs. 2,94,785.

STYRENE MONOMER: From Korea: BASF India Ltd., 243.499 MTs., Rs. 39,51,238.

DRUG MATERIALS IMPORTED BOMBAY

14.3.90

SULPHADIAZINE BP: From Hong Kong: Gorang International, 1,000 Kgs., Rs. 3,14,834.

PROPYLENE GLYCOL USP: From USA: The General Import Co. Inds., 16,770 Kgs., Rs. 2,94,066; From Singapore: M.J. Exports Ltd., 16.770 MTs., Rs. 2,94,068.

PLASTIC MATERIALS IMPORTED BOMBAY

14.3.90

HDPE: From Saudi Arabia: Associated Brothers, 83.8 MTs., Rs. 11,07,832; From Yugoslavia: Deluxe Plastics, 50 MTs., Rs. 8,12,624; Naresh Paper Bag Co., 62.5 MTs., Rs. 5,58,655; From Saudi Arabia: Pan Asia Intl. Pvt. Ltd., 17.15 MTs., Rs. 2,03,435; From Yugoslavia: Ravi International, 109 MTs., Rs. 18,05,924; From Japan: Sumitra Plastic Ltd., 16.5 MTs., Rs. 2,18,418.

LDPE: From Yugoslavia: Panorama Plastics, 65 MTs., Rs. 9,41,902; From Qatar: Prima Resources, 16.5 MTs., Rs. 1,99,987; From Yugoslavia: Gelra Agencies, 200 MTs., Rs. 28,98,160; From Netherlands: The Bharat Vijay Mills Ltd., 90 MTs., Rs. 13,15,143; From Saudi Arabia: Hukumchand & Sons, 24.75 MTs., Rs. 3,72,314; The Supreme Inds. Ltd., 115.5 MTs., Rs. 14,69,426.

MATERIALS EXPORTED MADRAS

(From 2.3.90 to 9.3.90)

BARIUM CARBONATE: To Keelung: Kores Ind. Ltd., 20,000 Kgs., Rs. 1,05,000; Travancore Chemical Mfg., 20,000 Kgs., Rs. 98,160.

BARIUM CARBONATE 98%: To Keelung: Travancore Chemicals Mfg. Co. Ltd., 40,000 Kgs., Rs. 1,92,919.

CAUSTIC SODA: To Colombo: Chemicals & Plastics India Ltd., 3,17,400 Kgs., Rs. 22,74,474.

HYDROGEN PEROXIDE: To Haifa: ICI Corpn., 35,000 Kgs., Rs. 2,60,936; To Jakarta: Asian Peroxides Ltd., 17,280 Kgs., Rs. 1,25,011; To Keelung: Asian Peroxides Ltd., 34,560 Kgs., Rs. 3,13,491; To Manila: Asian Peroxides Ltd., 34,560 Kgs., Rs. 2,95,380; To Singapore: Asian Peroxides Ltd., 34,500 Kgs., Rs. 2,87,944.

METHYL 3,3, DIMETHYL 4 PENTONATE: To Felixstowe: ICI India Ltd., 14,842 Kgs., Rs. 30,75,956.

SODIUM HYDROSULPHITE: To Genoa: Tamilnadu Chemical Products Ltd., 16,800 Kgs., Rs. 2,83,302; To Antwerp: Tamilnadu Chemical Products Ltd., 16,800 Kgs., Rs. 2,83,302.

ULTRAMARINE BLUE: To Abidjan: Ultramarine & Pigments Ltd., 10,500 Kgs., Rs. 3,81,166.

DRUG MATERIALS EXPORTED MADRAS

(From 2.3.90 to 9.3.90)

CHLORPHENIRAMINE MALEATE: To Hong Kong: Venkataramana Chemicals Ltd., 300 Kgs., Rs. 1,82,080.

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